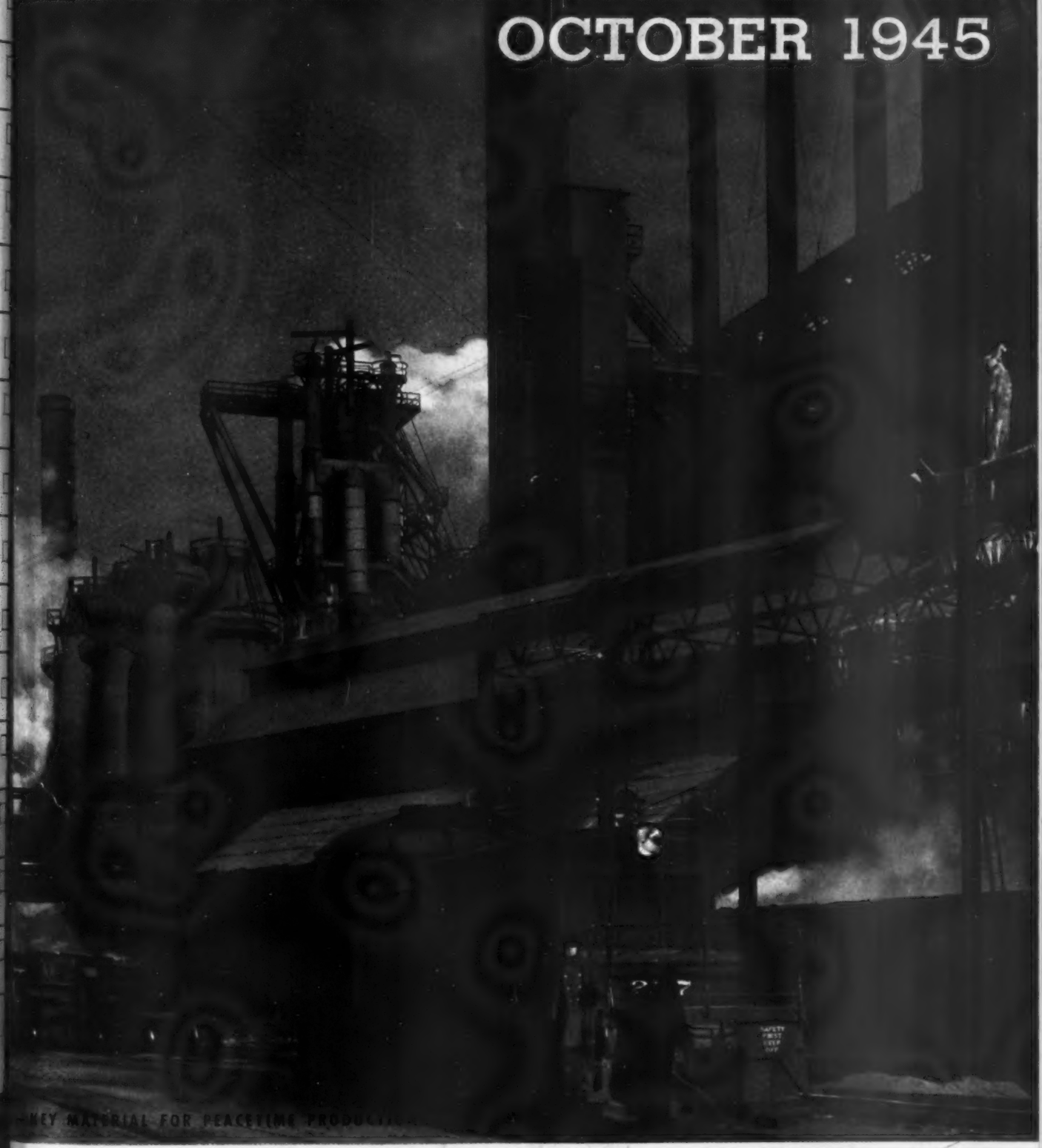
ENGINEERING LIB

OCT 2 3 194

FACTORY

MANAGEMENT AND MAINTENANCE

OCTOBER 1945



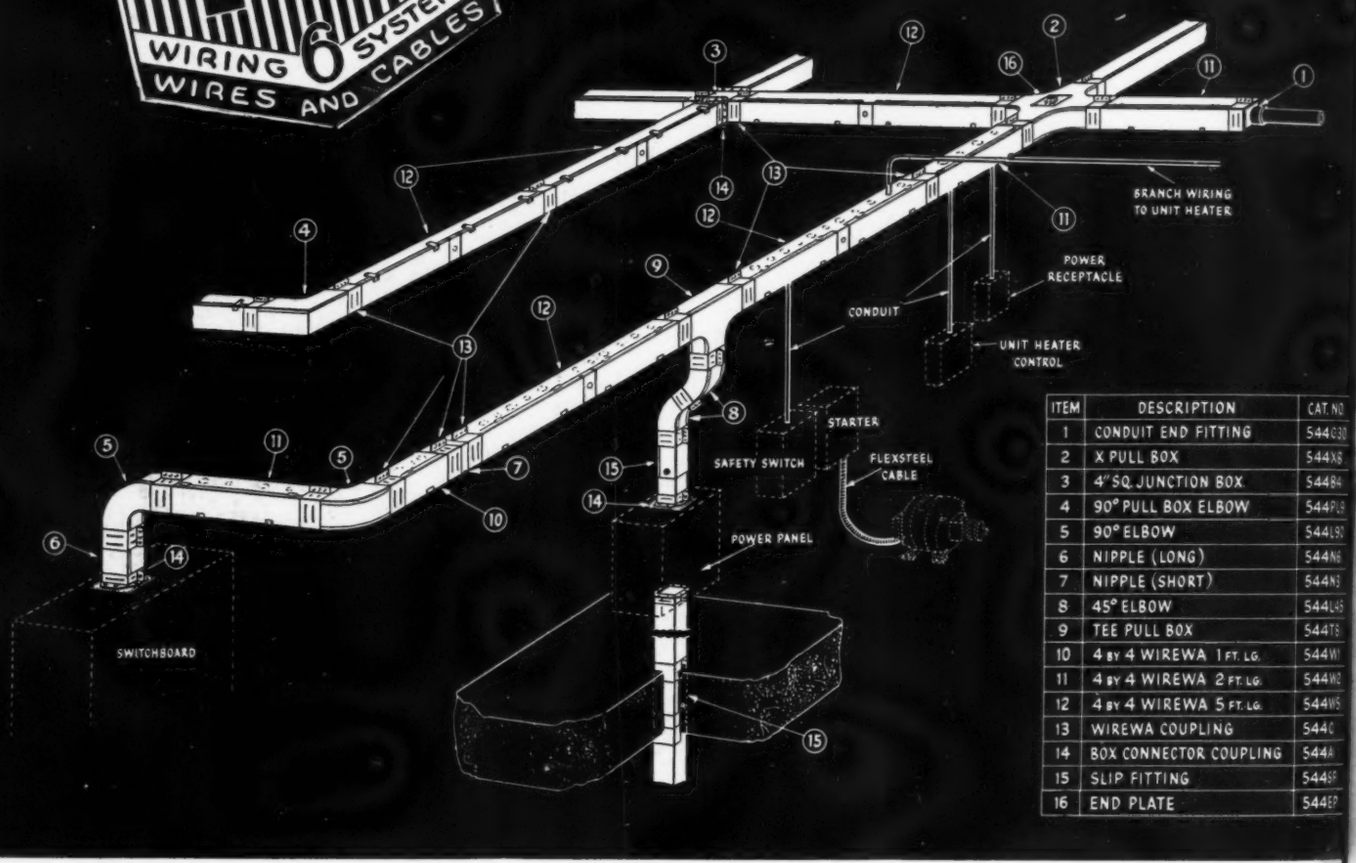
...KEY MATERIAL FOR PEACETIME PRODUCTION

We've Got to Settle Labor Problems at the Local Level ... *page 86*

Specify National Electric "4 x 4 WIREWA"

for industrial extensions and rewiring jobs

NATIONAL ELECTRIC PRODUCTS
WIRING SYSTEMS
WIRES AND CABLES



ITEM	DESCRIPTION	CAT. NO.
1	CONDUIT END FITTING	544C30
2	X PULL BOX	544X8
3	4" SQ. JUNCTION BOX	544B4
4	90° PULL BOX ELBOW	544PL9
5	90° ELBOW	544L90
6	NIPPLE (LONG)	544N6
7	NIPPLE (SHORT)	544N3
8	45° ELBOW	544L45
9	TEE PULL BOX	544T8
10	4 BY 4 WIREWA 1 FT. LG.	544W1
11	4 BY 4 WIREWA 2 FT. LG.	544W2
12	4 BY 4 WIREWA 5 FT. LG.	544W5
13	WIREWA COUPLING	544C
14	BOX CONNECTOR COUPLING	544A
15	SLIP FITTING	544SF
16	END PLATE	544EP

(sketch of a 4x4 WIREWA installation showing complete flexibility, simplicity and use of fittings.)

For housing of plant power systems and extension and rewiring of lines up to 600 volts, specify National Electric 4x4 WIREWA. Complete, easy to install, providing an area of 16 square inches and permitting an unusually high degree of flexibility and accessibility, this system has found wide acceptance in a variety of plants. Write for descriptive literature. National Electric also manufactures a complete line of wires and cables—famous for their long service and saving of space.

A FEW MAJOR REASONS WHY THE NATIONAL ELECTRIC 4 x 4 SYSTEM IS SO POPULAR

- Maximum usable space permitting greatest number of wires.
- Ease of installation and accessibility for tapping, rerouting, etc., without disturbing existing installation.
- Greater flexibility to meet specific local conditions.
- May be mounted direct to wall or by means of standard hangers suspended from the ceiling.

National Electric Products Corporation
Pittsburgh, Pa.

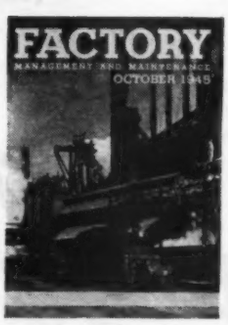
FACTORY

MANAGEMENT AND MAINTENANCE

October, 1945

Labor and Management Meet—for Peace or Civil War?.....*James H. McGraw, Jr.* preceding page 81
Reconversion Communique No. 6..... 81
The Economics of Wage Rates.....*L. C. Morrow* 85
We've Got to Solve Labor Problems at the Local Level..... 86
Matching Conveyor and Job.....*Walter F. Eitel* 92
Making Job Applicants Feel They Belong.....*Stanley R. Kuhns* 97
Training in Management for Supervisors.....*Charley H. Broaded* 101
Sylvania—a Case Study in Decentralization.....*Lewis K. Urquhart* 104
How Economical Operation Cut Plant Cafeteria Loss.....*M. A. Sherritt* 111
Meet Worker Trouble Where It Starts—and When.....*Whiting Williams* 114
Work Simplification for Foremen (*Plant Operation Library No. 89*).....*F. J. Titler* 117
How Constant Education Keeps Nine Plants Safe..... 125
New Jobs for War Workers..... 129
Putting Negroes on a Job Equality Basis.....*Charles A. Wood* 130
Paperwork for Smooth Flow and Close Control.....*E. L. Moore* 134
Significant Labor Developments.....*Benjamin Werne* 236
How to Sell a Training Program.....*Walter Dietz* 258
Maintenance as the Editors See It (*editorials*)..... 142
Modernizing an Old Plant for Low-Cost Production.....*Fleming W. Johnson* 143
Foremen Schedule Their Own Maintenance Work.....*Elmer A. Munson* 148
Better Welding Grounds Stop Shock Hazards.....*A. S. Durkie and K. G. Millington* 150
Third-Shift Repairs Save Machine Downtime.....*W. L. Georgan* 152
The Cost of Maintenance in Seventy-five Industries.....following page 152
Saving With Rechargeable Flashlight Batteries.....*M. A. Raney* 153
Now Cleans Floors Faster.....*Victor C. Hoffman* 154
How to Make Insulation Resistance Measurements.....*Graham Lee Moses* 156
Mechanical Power Transmission Equipment..... 162
Data Sheets: Driven Shaft Speeds..... 168

Management Shorts .. 139
Maintenance Shorts .. 164
Equipment News..... 172
You Want to Know.... 224
They Say and Do..... 268
Books 308
Calendar 312
Catalog Service 322



COVER PICTURE

There will be no reconversion slowdown for want of steel. Plenty of this key material will be available in the months just ahead. Kodachrome taken at Carnegie-Illinois Steel Corporation.

Factory Management and Maintenance is a consolidation of Factory and Industrial Management (including "Factory") and Maintenance Engineering. Price 35¢ a copy. Publication office, 99-129 N. Broadway, Albany, N. Y. Address communications about subscriptions to Director of Circulation, 330 W. 42nd St., New York 18, N. Y. Subscription rates—United States, U. S. Possessions and Latin American Republics: $3, 1 year; $4, 2 years; $5, 3 years. Canada: $3.50, 1 year; $5, 2 years; $6, 3 years. Other countries: $5 or 30 shillings, 1 year; $8 or 48s, 2 years; $10 or 60s, 3 years. Please indicate position and company connection on all subscription orders. Cable Address, "McGraw-hill, New York." Member A.B.P., Member A.B.C.

Copyright 1945 by McGraw-Hill Publishing Co., Inc. All rights reserved.

Factory Management and Maintenance, October, 1945, Vol. 103, No. 10. Published monthly, McGraw-Hill Publishing Co., Inc. Editorial, executive and circulation offices, 330 West 42nd Street, New York 18, N. Y. Entered as second class matter, November 13, 1936, at Post Office, Albany, N. Y., under Act of March 3, 1879.

District Managers: G. E. Pomeroy, Boston; L. E. Crist, Chicago; R. C. Greiner, Cleveland; T. W. Van Winkle, Detroit; J. S. Cawley, Joseph Gilbert, New York; E. Macaulay, Philadelphia; R. W. Garrison, Pittsburgh; C. J. Coash, St. Louis. Other offices at Atlanta, Los Angeles, San Francisco, Washington and London.

McGRAW-HILL PUBLISHING CO., INC.

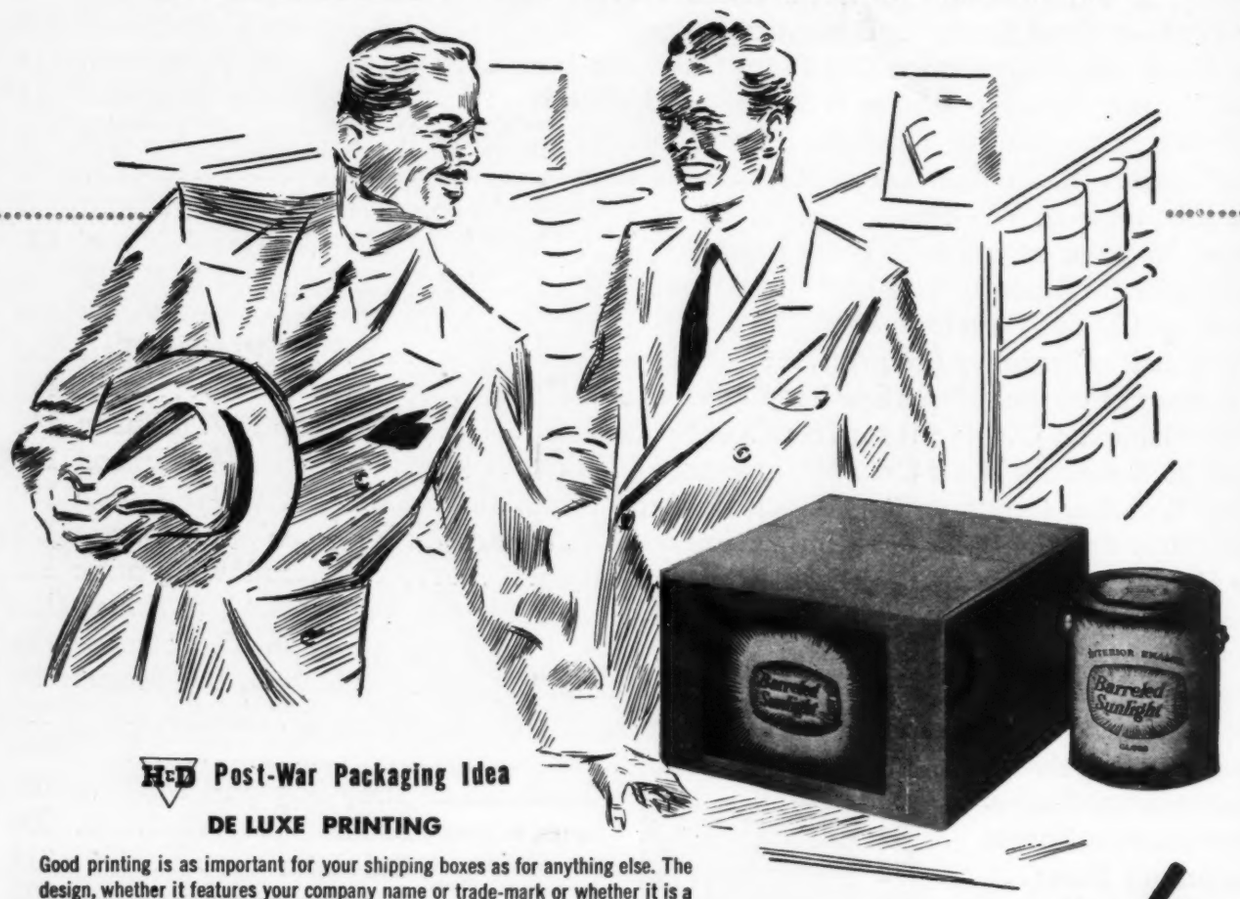
JAMES H. McGRAW
Founder and Honorary Chairman

JAMES H. McGRAW, JR., President; CURTIS W. McGRAW, Senior Vice-President and Treasurer; HOWARD EHRLICH, Vice-President (for business operations), WILLARD CHEVALIER, Vice-President (for editorial operations), JOSEPH A. GERARDI, Secretary, and J. S. BLACKBURN, JR., Director of Circulation.

ALFRED M. STAEHLE, Publisher
L. C. MORROW, Editor
LEWIS K. URQUHART, Managing Editor

G. A. VAN BRUNT, C. B. COATES, Associate Editors • KATHLEEN NORTH, CARL G. WYDER, RICHARD R. TRYON, Assistant Editors • A. H. MOGENSEN, WHITING WILLIAMS, Consulting Editors • H. P. DUTTON, Chicago • C. B. GORDY, Detroit • E. J. STRICKLAND, Los Angeles • DONALD D. HOGATE, Washington • H. E. HILTY, Sales Manager.

Printing is Important It takes real skill to print a corrugated shipping box correctly, to combine colors harmoniously, to create designs that appeal, attract, advertise, and sell. Yes, it takes plenty of know how, plenty of experience, plenty of doing. Good box printing is the result of years of experimentation and testing. It's the result of a thorough study of inks, colors, paper stocks, plate work and presswork. You can depend on high quality printing everytime from H & D.



H&D Post-War Packaging Idea

DE LUXE PRINTING

Good printing is as important for your shipping boxes as for anything else. The design, whether it features your company name or trade-mark or whether it is a sales display, adds real value to the package as a whole. To be sure you are getting quality box printing, send for a copy of the H & D booklet, "Pack to Attract."

Hinde & Dauch

AUTHORITY ON PACKAGING

THE HINDE & DAUCH PAPER COMPANY, 4547 DECATUR STREET, SANDUSKY, OHIO

Factories in BALTIMORE • BOSTON • BUFFALO • CHICAGO • CLEVELAND • DETROIT • GLOUCESTER, N. J. HOBOKEN • KANSAS CITY • LENOIR, N. C. • MONTREAL • RICHMOND • ST. LOUIS • SANDUSKY OHIO • TORONTO

LABOR *and* MANAGEMENT MEET— *for* PEACE *or* CIVIL WAR?

THE prospect of a knock-down and drag-out fight in the automobile industry does not augur well for the reconversion outlook, which upon every other score is bright. Any widespread outbreak of the type of industrial warfare which now threatens will disrupt, more thoroughly than anything else on the horizon, an orderly transition to a peacetime economy.

It is doubly unfortunate that there should be a general tightening of union and company battle lines upon the eve of the Labor-Management Conference, which on November 5th will convene at President Truman's direction for the purpose of "working out by agreement means to minimize labor disputes." If the current work stoppages occasioned by industrial conflicts should increase rather than diminish between now and November first, the Conference atmosphere hardly promises to be favorable to a dispassionate examination of basic issues.

Yet the shadow of the threatened industrial storm that hangs over the Conference only serves to emphasize the importance of reaching satisfactory agreement upon two problems with which such a Conference might deal. The first is that of determining what machinery shall be used for settling disputes upon which employers and workers have reached an impasse. The second, and more far-reaching, is that of arriving at some common understanding upon the major issues which commonly lead to irreconcilable disputes.

Settlement of Wartime Disputes by the War Labor Board

During the war the first problem was handled largely by machinery centered in the National War Labor Board. Supported by general adherence to patriotic pledges by labor leaders and employers not to resort to the use of economic force against each other during wartime, and backed up on rare occasion by use of the President's power to seize plants for war purposes when its orders were not obeyed, the Board managed, by what amounted to compulsory arbitration, to settle the nation's wartime labor disputes with relatively little economic loss.

But it can scarcely be claimed that the War Labor Board did much to resolve the issues from which disputes grow. Indeed, the fact that it was available to issue orders in cases which the Secretary of Labor certified as likely to "lead to substantial interference with the war effort", resulted in the conversion into full fledged disputes of many disagreements which would otherwise have been settled at a local level in the course of collective bargaining. Meanwhile, local collective bargaining machinery which should have been doing most of this work was neglected, and will need thorough reconditioning even to be brought back to its prewar level of effectiveness.

With V-J Day came an abrupt change in the status of the War Labor Board. One of its main props, labor's "no strike pledge", was promptly withdrawn. It could no longer rely on the President to use his power to seize plants for war purposes to force obedience to its orders. Consequently the Board agreed that it would accept new cases only if both parties to the dispute stipulated in advance that they would abide by the Board's findings, that it would clear its dockets of old cases as rapidly as possible, and that it would then go out of business, leaving to the Labor-Management Conference the question of what should take its place in the postwar period.

What Shall Take the War Labor Board's Place?

The immediate and pressing task of the Labor-Management Conference is to agree upon machinery for settling industrial disputes in the peacetime economy.

Neither management nor labor wants the continuation of compulsory arbitration to which they submitted as a necessary war measure. But it must be clear to everyone that if any substantial proportion of the disputes that inevitably arise are settled by resort to strikes and lockouts, economic anarchy will result. Not only will it be impossible to achieve the high levels of output and employment that have been set as postwar goals, but it is questionable whether our economy could survive. The only alternative to compulsory arbitration under government auspices is for management and labor to demonstrate their ability to effect a peaceable resolution of their differences without it.

The most obvious need is to set up local machinery at the grass roots where disputes originate. That is where most of them should be settled by local negotiation and, when that fails, through voluntary submission to mediation or arbitration under terms of reference to which the parties agree. Many issues, which at plant level are relatively simple in character, are blown up to formidable dimension and complexity when they are passed along

the line for decision in Washington. The centralizing process is one that frightens everyone connected with it because it focuses attention upon the possible importance of precedents established by a decision, rather than upon resolving satisfactorily the particular dispute at hand.

Unquestionably, some Federal machinery must be provided which may be called upon in cases where the size or implications of a threatened dispute clearly run beyond local jurisdiction. That will mean the thorough revamping of conciliation and mediation machinery which exists, but which has grown rusty through disuse while compulsory arbitration was the order of the day.

At least, this involves a complete overhauling of the United States Conciliation Service with a noteworthy strengthening of its personnel. There may be wisdom also in recently advanced suggestions for the creation of a board of arbitration to act in cases voluntarily submitted by the parties concerned, and for boards of inquiry to make reports upon the merits of disputes in which the public interest is concerned. But there is valid ground for questioning what appears to be the common assumption that such machinery should be located in the Department of Labor. It belongs neither there nor in the Department of Commerce. For the work which such agencies are called upon to perform, both the appearance and fact of complete impartiality are essential to effective performance. Assurance of impartiality will not be fostered by placing them in a department specifically charged by Congress with the task of advancing the interests of wage workers.

Resolving the Issues Over Which Disputes Arise

It may be, as many think, that the forthcoming Labor-Management Conference cannot effectively handle any problems beyond the procedural ones suggested above. If that is true, its agenda probably should be restricted to planning the reconstitution of collective-bargaining and dispute-settlement machinery, in view of the urgent need for putting it in working order.

But either in this Conference, or in subsequent ones, there will have to be an attempt to reach a reasonable measure of labor-management accord upon certain basic issues over which most industrial disputes originate. The best of machinery can be swamped if disputes are generated in ever-increasing number.

Most important of such issues is that of the fair determination of wages. There is clear need for reaching agreements at least upon the major factors on which such determination should rest. It seems evident that if we are ever to hope to reach the high levels set and generally accepted as postwar goals, we must harness economic incentives to promote production efficiency. That means that workers, as well as management, must be given a genuine stake in increased productivity. No universal formula is possible, but we should be able to agree upon general principles for dividing returns derived from improved performance in output between workers and investors, and consumers in the form of lowered prices.

Again, since unionism is here to stay, general acceptance by management of the principle of collective bargaining would save innumerable disputes which are concerned more with the method of negotiation than with the concession sought. Few in management still question the validity of the collective bargaining process as such, but there are many matters to be resolved of which the question of the open shop, the union shop, or the closed shop is merely a conspicuous example, upon which there is wide divergence of conviction between and within labor and management groups.

On the management side, there is sincere concern about the intent or ability of union leaders to exercise responsible control that assures compliance with contractural obligations. Wild-cat strikes are of sufficiently frequent occurrence to give substance to this distrust, and union discipline seldom has been administered in a decisive or effective fashion. The prospective rivalry of three competing labor organizations of national scope gives management little confidence that a bargain made and kept in good faith with any one of them provides assurance against work stoppages.

All of these matters, and many others, need thrashing out between management and labor, with the view of arriving at as large a measure of specific and detailed agreement as can be achieved. The greater the area of such agreement, the smaller will be the area for disputes that must be handled by settlement machinery, or put to the final test of force.

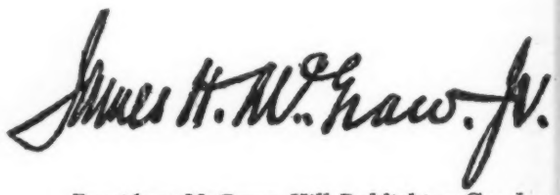
Peace or Civil War in Industry

The Labor-Management Conference is of major importance to national welfare. It is important even if it restricts its objectives to the procedural problem of how industrial disputes are to be handled.

It can make an even larger contribution if it lays the groundwork for an attempt to reach working agreements upon such policy issues as have been cited above.

Neither management nor labor can afford to lend anything less than their best intelligence and effort to an attempt to arrive at common understanding. Success will mean that we have a genuine chance of reaching new levels of economic well-being. Failure will mean industrial civil war, in which the casualties will be high. One almost certain casualty of such a war will be the principle of collective bargaining, since the Government can scarcely refrain from establishing compulsory arbitration if sufficient breakdown occurs.

It is to the vital interest of both management and labor to demonstrate that they can responsibly control themselves.



President McGraw-Hill Publishing Co., Inc.

REC

Reco
omic
V-J
tries—
an en
in the
began
Ne
omy c
before
of str
Pri
factur

1.
home
miner

2.
wage

3.
compa

4.
past p

5.
granti
cessor,

6.
as wav

7.
Run
contin
perma

St

Most
versio
125,0
the ou

PROSPECTS FOR INDUSTRY 10 WEEKS AFTER V-J DAY

RECONVERSION PROGRESS CONTINUES on the American economic front—but not without troubles.

V-J Day plus 10 weeks found the manufacturing industries—keystone of America's economy—holding firmly to an employment total approximately 28 percent higher than in the best previous peacetime year. Retail establishments began to reflect reconversion progress.

Nevertheless, efforts of management to push the economy quickly to higher levels of general prosperity than ever before seen, were nullified in some places by an epidemic of strikes.

Principal factors now influencing trends in the manufacturing industries are as follows:

1. **Strikes.** Principal objective is maintenance of take-home pay. Fuel shortage worsened by widespread strike of miners; unionization of foremen involved.

2. **Labor-Management Conference.** Arbitration and new wage formulas likely to be topics at November 5 meeting.

3. **Plant Expansion.** Reports to FACTORY show many companies have started, or are ready with, expansion projects.

4. **Employment.** Total number at work continues above past peacetime levels. CED calls for employment study.

5. **Controls.** OPA expected to give ground slowly in granting price increases. WPB to die November 3. Successor, Civilian Production Administration.

6. **Legislation.** Labor bills meet stubborn opposition as wave of strikes leaves Congress indignant.

7. **Trends.** Kaiser-Frazer combination to operate Willow Run . . . Lumber problem again grows serious . . . Efforts continue to make Fair Employment Practices Committee permanent . . . U. S. population now 139,682,000.

Strikes

MOST DAMAGING among the strikes to the progress of reconversion was the walkout of about 28,000 foremen and about 125,000 workers in bituminous coal mines. This reduced the output of coal so sharply as to force a serious slump in steel mill operations, and the growing shortages of both coal and steel threatened to paralyze a large part of all other manufacturing industry.

Shutdown of the mines again brought to the forefront of labor relations problems the right of management to insist that the men it appoints as foremen—to deal with union labor—shall not be members of labor organizations themselves. But the objections of top management have not stopped left-wing agitators and organizers from needling foremen with extravagant lures.

What happened in this case was that efforts were being made by District 50, the "catch-all" union of John L. Lewis's United Mine Workers, to organize the foremen. During this organizing effort, some foremen went on strike. That served as an excuse for the regular United Mine Workers to walk out, completely shutting down the mines, yet contending that the UMW was not on strike. Since the operators' contracts with UMW provide that certain classes of supervisors are not eligible for membership in UMW, Lewis claimed that the absence of the miners from the mines was due to occupational hazards caused by absence of the foremen. That left no way of showing whether the mines were shut down because of absence of the foremen, or whether the absence of the foremen was caused by the shutdown of the mines. In turn, it permitted Lewis, who had jockeyed the operators into signing the UMW contracts—exempting supervisors—to "invite" the operators to go to Washington to confer with him about the supposed union-recognition demands of the foremen. His invitation was promptly rejected.

Because of the effect of fuel shortage on industry in general, and because of the foremen issue involved, the mine shutdown was the most important among the widespread strikes of the early post-war period, and the most significant to manufacturing industry.

There were plenty of other strikes, however, that were downright serious. Among the worst was the UAW-CIO walkout of 4500 at Kelsey-Hayes. This lasted about six weeks and caused 50,000 other unionists at Ford Motors to stand idle for part of that time.

Most of the other strikes that occurred in September and October involved union demands for larger wages. CIO unions were most frequently involved, and in a large number

Trends Shown by Recent Strikes

Participants	*Directly Involved*	*Objective*	*Damage Done*
COAL			
Mine Foremen (UMW—Dist. 50)	28,000	To force companies to deal with foremen through unions	Gradual shutdown of steel mills and other industries. General coal shortage. Production cut by about 700,000 tons per day
United Mine Workers	125,000	John Lewis says UMW can't dig without foremen on job	Same as above
OIL			
Oil Workers International (CIO)	37,000	30 percent wage increase	Cut oil production about 35 percent, causing added fuel trouble for industries and private consumers
AUTOMOBILES			
United Automobile Workers (CIO) at Kelsey-Hayes	4,500	Protest against discharge of three men who beat foreman	Made 50,000 workers idle at Ford plants. Indirectly affected many more
Foremen at Hudson Motors	500	20 percent wage increase	Made 6000 other Hudson workers idle
COMMUNICATIONS			
National Federation of Telephone Workers (Independent)	200,000	Protest against NLRB ruling and organizational efforts made by CIO	Shut down long distance telephone service for 4 hours
MATERIALS			
Lumber Workers (AFL)	60,000	Minimum of $1.10 per hour	Worsened the shortage of lumber critically needed for reconversion
ELECTRICAL MANUFACTURING			
Office Workers Union at Westinghouse (Independent)	12,000	To seek bonus payments for office workers like those paid shop workers	Made 27,000 shop workers (CIO) idle. Reduced output of electrical goods

Each symbol represents 10,000 workers

of these strikes there was significantly a standard demand for a 30 percent increase.

At the October peak of the wave of strikes, approximately 425,000 men were idle in struck plants, and about 1,500,000 others were made idle by strike-caused shortages of materials.

Labor Conference

AN IMPROVED FORMULA for seeking peaceful settlement of disputes between management and labor will be the chief objective of the Labor-Management Conference to be held in Washington on November 5. But astute observers are not expecting any magic.

Some representatives of unions and others of the government are expected to favor some kind of semi-compulsory arbitration. Basic opposition of management to this will stem from the fact that not all points of disputes are proper subjects for an arbitration procedure.

The Washington conference supposedly will limit discussions strictly to the scope of an agenda accepted in advance by a majority of the participants. However, it will be difficult to shut off talk on subjects not on the agenda when practically any *tabu* topic will be related inevitably to other topics which have been approved.

Thus, one way or another, may also arise a new approach of some unions to the related topics of wages and security—a formula that calls for granting a 30 percent hourly wage increase but provides for ending time-and-a-half rates when work exceeds 40 hours a week during peak periods. Coupled with this, however, is a third provision by which the companies would guarantee 2080 hours of work per year to a specified number of employees.

One of the other points that may come before the conference is a call for repeal of the Smith-Connally Act, based on the charge that it is a waste of the public's money for the government to spend $100,000 or more to take a strike vote of a company's employees under present conditions.

As now employed, the outcome of a strike vote under this act is rarely in doubt, the critics point out, because the labor rank and file are easily persuaded by the leaders that any demands their leaders formulate are fair and right; that making extravagant demands and then backing them up by a show of force in the form of a strike threat is a legitimate bargaining practice; and that the only way to win a maximum of benefits is to apply to the bargaining a maximum of force.

Preliminary arrangements for the conference called for the attendance of eighteen representatives of industry, to be nominated by the National Association of Manufacturers and the United States Chamber of Commerce, eighteen representatives of AFL and CIO, and one representative each from the United Mine Workers and the Railroad Brotherhoods. Others to be present will include Secretary Schwellenbach and Secretary Wallace.

Plant Expansion

DESPITE THE STORM CLOUDS on the labor horizon, leading American manufacturers are engaged in billions of dollars' worth of expansion and improvement projects. The number of companies involved, it is apparent by sampling, exceeds 100,000. Even the "giants" are too numerous to be mentioned individually, but typical concerns which have replied to inquiries by FACTORY show the trend in reliable fashion.

Typical additions to "Reconversion Rebound" (see Communiqué No. 5, FACTORY, September, 1945) include:

The Dow Chemical Company, Midland, Mich.—Planning a $20,000,000 expansion over the next 12 months, in Michigan, Texas, California, and Ontario.

Royal Typewriter Company, New York—Adding new and improved machine tools generally, and 127,000 square feet of additional floor space.

Caterpillar Tractor Company, Peoria, Ill.—Will spend $7,000,000 for modernization and rehabilitation of plant and equipment.

Air Reduction Company, New York—Plans to spend $25,000,000 in next 12 months for plant improvements. Already started is a $6,500,000 group of projects for industrial gas and dry-ice plants, and for improved research, distribution, and warehouse facilities.

Typical of a large number of other programs which are definitely scheduled but which were described to FACTORY with the restriction that the names be withheld, are the following:

A manufacturer of transportation vehicles will spend $50,000,000 for various additions and improvements. These include 36 miles of conveyors, about 250,000 square feet of added floor space, and improved and enlarged facilities for employees, such as larger and more modern washrooms and better lighting.

A medium-sized manufacturer of household electrical devices will spend nearly $8,000,000 for modernization, rehabilitation, and additions to plant and equipment.

An automobile parts manufacturer, small in comparison with his corporate customers, nevertheless is counting on spending more than $1,000,000 to take over a government-owned factory and much of its equipment for expanded employment and production.

Authentic reports like these have reached FACTORY from all parts of the nation—all of them showing an unmistakable trend.

Employment

THE RAPID REBOUND of employment in the national economy and especially in the manufacturing industries has pretty well silenced most of the pessimists who, for one reason or another, were predicting 60 days ago that there would be six to eight million unemployed in America before snowfall.

Even those who wanted to scare the nation and Congress into hasty adoption of the Murray Full Employment Bill and the Kilgore Unemployment Compensation legislation by predicting unemployment in huge doses, haven't been able recently to make their grave "worries" hold water. The best figures available on unemployment so far yield an average of less than 2,000,000—and even this is largely a synthetic unemployment, rather than the "real thing."

The fact remains that almost constantly since V-J Day the number of job opportunities going begging has ranged

from half to three-quarters as many as the number of men and women who have been described as unemployed. FACTORY's *Reconversion Communiqués* repeatedly have pointed out this fact, and have been one of the few spokesmen that have consistently insisted that true unemployment during the year of reconversion would be relatively small—consisting principally of the average numbers of people who are always in an in-between status after leaving one job and while doing normal job-hunting for another.

After studying unemployment reports from all reliable quarters again this month, and the outlook for production and employment requirements for the manufacturing industries, FACTORY sees no reason to change its conclusions given in detail last month.

Among the few other agencies that have reflected an optimism similar to this are the Committee for Economic Development, and leading trade associations. Latest effort of the CED to safeguard the nation against serious unemployment is a report of its Research Committee recommending the immediate appointment by President Truman of a Presidential Commission on Full Employment, and the appointment of a Joint Congressional Committee to share in dealing with this general subject.

CED believes that instead of government's having an agency or agencies, and private industry's having various agencies, all working more or less independently though with a common subject, as at present, it would be wise to create the two commissions specifically to study suggestions and programs coming from outside the government as well as others emanating from men in public office.

The President's commission, CED recommends, should be a small working body composed of the ablest men to be found, and chosen as representatives of the general public interest. The Joint Congressional Committee, according to the CED, should be composed of the ranking members of the Senate and House committees which now deal with major problems affecting the economy.

Controls

HEAVIEST HAND AMONG THE WARTIME CONTROLS of government on industry that still remains is OPA's. Here is the point where price ceilings are still clamped on, or left in a state of uncertainty. The result is that some companies find it difficult to know what wages they can afford to pay, or, having agreed on wages, to know whether they will be allowed to get a price for products high enough to cover all categories of costs.

But even the OPA is engaged in a retreat. For a while longer it intends to keep a firm lid on prices, as an argument in trying to keep wages from pushing the country into inflation. It is a theory of the OPA and of labor leaders and the federal administration generally that, although production costs may be too high for present price ceilings during the next few months (before mass production technique gets back into high gear), it will be better for the economy to suffer a temporary loss in that squeeze than for prices to go up now, and then be followed by more wage hikes later. In spite of this theory, qualified observers say that OPA will soon be forced to liberalize considerably its policy on prices to prevent it from bottlenecking industry's reconversion program.

Replacing the War Production Board after November 3 will be a cut-down unit to be called the Civilian Production Administration. It will have authority to break bottlenecks and to exercise a number of other functions, but barring the possibility of some unexpected emergency its greatest service is expected to be in helping industry solve shortages of critical materials, such as rubber. In command of CPA will be Capt. J. D. Small who was deputy to Chairman J. A. Krug of WPB.

Legislation

CAUTIOUS HANDLING BY CONGRESS now marks the status of most of the pending legislation that has the backing of labor. The status is as follows:

Full Employment Bill—Basic statement has been revised to read that all Americans able and willing to work are entitled to have an *opportunity* to work. But even with this added caution, the bill may be further amended if and when it is adopted.

Unemployment Compensation Bill—Opposition to the "why not take a vacation and call it unemployment" features of the original bill, and a feeling among Congressmen that labor strikes were becoming the chief threat of wholesale unemployment, led to the pigeonholing of this bill.

Minimum Wages Bills—There are two or three bills pending to lift the minimum standard of wages from the present 40-cent hourly level to about 65 cents. Opposition recognizes the fact that most people are worth more than 40 cents hourly and receive more than 40 cents hourly. But it also points out the fallacy of ignoring the fact that there are "some folks who are hardly worth a dime."

Tax Bill—Although Secretary Vinson recommended elimination of the excess profits tax on corporations, the House of Representatives subsequently passed its own tax bill which merely would reduce the rate in this category from the present 85.5 percent to 60, and would cut the combined normal and surtax on corporations from its present maximum of 40 percent to 36. The vote was 343 to 10. However, Senator George, chairman of the Senate Finance Committee, said he still favored full repeal of the excess profits tax, and that open hearings on the bill would be held, providing new opportunity for proponents of repeal to be heard.

Events and Trends

HENRY J. KAISER AND JOSEPH W. FRAZER have signed a corporate lease to produce automobiles in the government's Willow Run plant. . . . Increasingly serious threat to reconversion is the lumber bottleneck which should be gradually disappearing but instead is being aggravated by the strike of lumber workers in the Pacific Northwest. Lumber from the Southern states, however, will go far to meet many of the nation's needs during the next few months of winter weather. . . . Friends of the Fair Employment Practices Committee are still at work to get this temporary agency changed over to a permanent basis. . . . Recent estimates of the Census Bureau indicate further increase in U. S. population during the war years to a present level of 139,682,000.

FACTORY
MANAGEMENT AND MAINTENANCE
L · C · MORROW · EDITOR

The Economics of Wage Rates

Increases in wage rates should be neither sought nor refused on the basis of emotion. There is enough of factual foundation to make emotional appeal unnecessary. Here are some of the unavoidable economics of the wage-cost-income relationships—economics that have a way of asserting themselves in the long run regardless of emotion:

1. Labor is paid in proportion to productivity. (When measured in relationship to "value added to raw materials by manufacture," labor always has received just about 40 percent of such increased value of the physical output of our factories.)

2. The purchasing power per average worker is proportionate to the output per worker. (On the basis of 1909 = 100, the purchasing power had advanced to around 235 in 1940.)

3. The purchasing power and employment opportunities of labor are greatest and best maintained in the industries paying out as wages the lowest percentages of value created by manufacture. (As a rule, the most highly mechanized industries, such as petroleum refining and electrical machinery, are in this class.)

4. The fewer the workers required per unit of time to produce the goods needed for a given population, the higher the standard of living of that population. (The prices for industry's products are lowered as the number of workers diminishes, the number of hours worked per day or per week is reduced gradually, and more people are employed in the service occupations.)

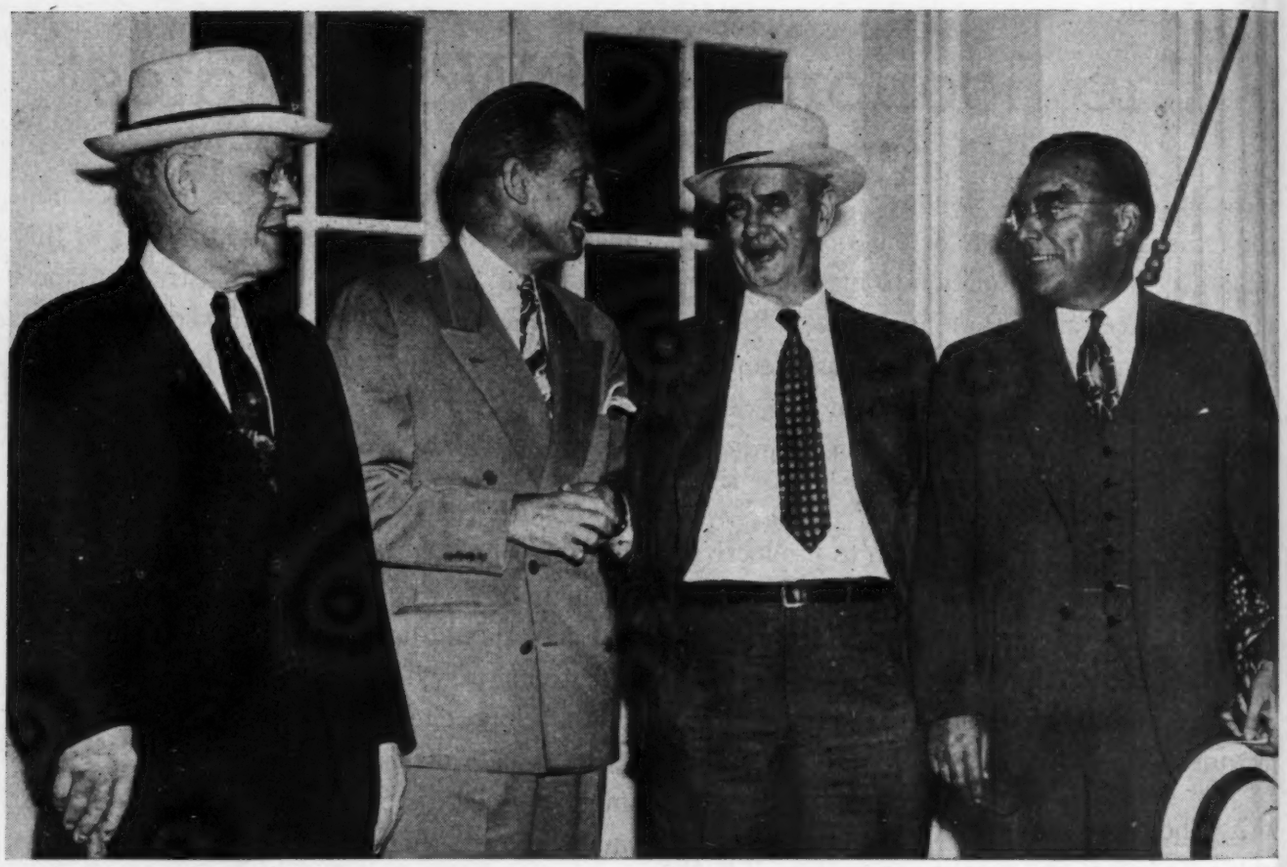
Organized labor is seeking all the traffic will bear. How much the traffic will bear will depend upon productivity.

Labor should be given all the traffic will bear when determined in the light of the economic relationships cited here. Labor makes up the greatest part of the population, and consumes most of industry's products. Its purchasing power must be kept as high as possible.

The interests of ownership, management, and labor are identical. If all three could recognize the few fundamentals that control the long-time economic position of wages, and work cooperatively to adhere to them, we should have none of the existing dangerous interruptions to the program of immense production required for our national welfare.

L C Morrow

We've Got to Problems at



While top leaders of labor and management (left to right, William Green, Eric Johnston, Philip Murray, and Ira Mosher) met at White House to lay groundwork for harmony conferences . . .

THE LABOR THUNDERCLOUDS are darkening. In Washington the top men in management and labor are meeting to stave off the storm's worst effects. Will they perceive in time the true nature of the underlying problems?

Congress can investigate. The White House can issue directives. Philip Murray, William Green, and any combination of labor leaders can meet with Ira Mosher, Eric Johnston, and any combination of management men. They can pledge everlasting harmony and sign treaties without end.

But nothing will come of it unless some way can be found to control the recalcitrants at the local level.

This is a discouraging thing to say. Labor harmony is a desperate national need. No one wants lightly to cry down its prospects. Yet hope will be dim as long as: (1) Labor remains divided within and against itself; (2) national labor leaders knuckle under to the undisciplined rank and file; (3) labor relies on a greatly overrated political blackjack to forestall strong action against it by government.

Does this throw the onus too heavily on labor? True, there are recalcitrants in management, too. But controls over them exist. Most of government's rulings lean labor's way. And government freely uses its powers to make management comply. This raises another issue of equal importance:

Will government ever find the courage to use its powers impartially?

Until it does, labor won't be ready

Solve Labor the Local Level

Press Association photographs

. . . undisciplined local labor struck at Kelsey-Hayes Wheel Company, Detroit. These strikers are picketing the executives of their own CIO union, United Auto Workers, in protest against back-to-work order

for the real solution—which is free agreement between management and labor at every level with both sides responsible to public opinion.

Example Number One—Kelsey-Hayes

The story of Kelsey-Hayes is a tale of two cities—Washington, where "policy" is made, and Detroit, where things happen.

In Washington in late August, plans were being laid for the national labor-management harmony conferences which are due to begin November 5 or sooner. Secretary of Labor Schwellenbach wasn't keen on the idea when Senator Vandenberg initiated it. But President Truman insisted.

So preparations began. Frequent callers at the White House and the Labor Department were Murray of CIO, Green of AFL, Mosher of NAM, and Johnston of the United States Chamber of Commerce. During one White House conference a tiny harbinger of peace appeared. It was raining when the quartet came out. Soon Murray and Mosher were seen arm in arm, huddled under Mosher's umbrella, chatting and laughing like the best of friends.

In Detroit, however, 4500 employees of the Kelsey-Hayes Wheel Company were out on strike. *And the history of this strike should be better known to the American people.*

Some months ago, thirteen Kelsey-

Because Kelsey-Hayes strike cut off flow of parts, Ford Motor Company reconversion was halted. Here a few of the 50,000 laid-off Ford workers are reading the bad news in the Detroit papers

Hayes employees cursed a foreman obscenely and threw him bodily out of the plant. The thirteen were fired. Prolonged hearings were then held before a War Labor Board panel which took 600 pages of testimony.

Eventually WLB ruled that ten out of the thirteen, while guilty, were mere followers and should be reinstated, whereas three were ringleaders and should be fired. Among the three was one "Moon" Mullins who had been hired and fired for disciplinary reasons no less than eleven times.

They Struck Anyway—and Closed Ford

On August 23 the Kelsey-Hayes workers walked out in protest against the trio's discharge. In so doing they brought down the Ford Motor Company, Kelsey-Hayes's principal customer, in the midst of its vital reconversion task. On September 15 Ford laid off 50,000 workers. On September 20 it had completed only a fifth of scheduled output.

Rarely has such a clean-cut challenge confronted labor leadership—or government. There was no dispute over hours or wages. The only question was: Can 4500 CIO members defy all authority and make 50,000 CIO members idle for the sake of the rambunctious Moon Mullins and his trouble-making pals?

The answer, one month later, was "Yes." True, Pres. R. J. Thomas of UAW-CIO pleaded with the strikers —and was ignored. True, the UAW executive board declared the strike unauthorized—and was picketed. True, Thomas suspended the officers of the Kelsey-Hayes local and installed an international officer, Percy Llewellyn, as "receiver."

But nothing happened, during the month, except one Alice-in-Wonderland event, which could have occurred only in politics-ridden UAW whose leaders live in dread of their followers —and each other. As reported by *The New York Times* on September 18, the executive committee "took an optimistic view of Mr. Llewellyn's intervention" and one UAW official remarked: "The (Kelsey-Hayes) members were polite to him, and that's progress."

Actually this wasn't quite as strange as it seems. The Kelsey-Hayes local is dominated by a warring mixture of party-line communists and dissenting Trotsky-ites (rare birds, these days) bent on outdoing each other in revolutionary militancy. At one important strike meeting only 100 members showed up—to commit the other 4400 to continue the strike.

Meanwhile Richard Frankensteen, UAW vice-president, was striving mightily to coax the strikers back to work. Frankensteen is running for mayor of Detroit. The strike was obviously doing his meager chances no good. But he, too, got nowhere.

No Matter What Happens the Damage Is Done

The Kelsey-Hayes strike was more than a month old when this article was written. No matter what happens hereafter, the real damage has been done. Watching unionists elsewhere now know that every authority can be flouted with impunity for at least one month.

UAW thus lost a big chance to demonstrate union responsibility. And Secretary Schwellenbach lost a big chance to implement the Labor Day speech in which he said:

"Labor now has the opportunity to solve its problems and to make certain that the common good is not transgressed. And I plead with labor to assume this responsibility, knowing that, unless it does, government will be invited and even compelled to assume the responsibility."

There never was a better opportunity for a strong Labor Secretary to move in personally, on his own authority, and throw the glare of adverse public opinion on an utterly indefensible wildcat strike. Other such occasions will doubtless arise. But they will be twice as hard to handle because this one was neglected.

UAW's President Thomas may have been thinking, of course, of the case of Sherman Dalrymple, head of the United Rubber Workers-CIO. Throughout the war Dalrymple took a firm and conscientious hand with wildcat strikers. As a result he has been vilified vastly by the militants and may yet be driven out of his own union.

Secretary Schwellenbach may have been thinking of the "reorganization," recently announced, by which the Labor Department took jurisdiction over the War Labor Board and the United States Employment Service. This came as a consequence of many aggressive new moves on the part of CIO. The steel and rubber workers announced a new drive for a 30 percent increase in basic wage rates. UAW asked for a strike vote in the automotive industry, for the same objective. And many oil workers went out on strike.

These headline events took the emphasis off the Kelsey-Hayes strike. But its implications deserve closer scrutiny. Why should such strikes occur? Why should they continue to menace every attempt at labor-management agreement, even when apparently larger issues can be solved? Because:

1. They reflect the boss-hating militancy which CIO leadership has encouraged in the rank and file.

2. They reflect the CIO belief that any union can do anything it pleases under cover of the central organization's political omnipotence.

Finally they demonstrate the need for greater awareness that trivial disputes, neglected at the local level, can spread into national issues out of all proportion to their original importance.

CIO a Hunted Animal—Its Power on Wane

As a matter of fact, the CIO is a good deal of a hunted animal these days. Its vaunted political power is at low ebb. It relied too long on a White House "in," which it largely lost with the death of President Roosevelt. Now it is frantically mending its fences in Congress. The New York CIO's recent 600-man "march on Washington" is one example. Another is CIO's calling together of whole state delegations in Congress to hear its threats and pleas.

With relatively slim cash reserves and the fear of heavy loss of membership hanging over it, CIO also faces enemies within the house of labor. AFL waits like a lazy lion to reach out and scoop up the remnants of CIO unions shattered in factional fights. Nipping at CIO's heels is big District 50 of the United Mine Workers, membership now 250,000, well heeled for a new invasion of CIO's domain. No small threat, too, is the Mechanics Educational Society of America. UMW's John L. Lewis now has a White House "in" second to none. And if anyone cares less for labor harmony than he, it is MESA's frankly socialistic Matthew Smith.

What could the CIO do? Put the heat on in Congress. Expand propaganda activities among local ministers, educators, and other professional men (a big CIO activity). Make huge new national "demands" to appease the restive rank and file. (District 50 and MESA take an even more militant line than CIO.) Threaten an automotive strike for a 30 percent wage boost and for 3 percent welfare payments (see "Royalties for Unions," FACTORY, September, 1945).

In other words, agitate to hold membership. Capitalize on waning political prestige with an Administration and a Congress that still seem vote-conscious and timid. And howl to the high heavens for the Murray "full employment" bill if only for the reason that, if jobs are plentiful, your chances of survival are better. *That's what CIO is doing.*

Belatedly R. J. Thomas, UAW president (left), tried to quell the Kelsey-Hayes strike and met with some of the same rank-and-file abuse suffered by Sherman Dalrymple (right) of United Rubber Workers after sincere attempts to discipline wartime strikers

Is Labor's Political Threat a Scarecrow?

CIO would probably have to do more pleading and less threatening if politicians stopped to ponder a few facts. Some of the shrewdest political writers in Washington have heavily discounted the influence of CIO's Political Action Committee in the last election. They remember that John L. Lewis couldn't take the CIO with him when he espoused Willkie in 1940. They recall an axiom among seasoned labor leaders that "there is no such thing as the labor vote." And there is other evidence that labor's political threat is a good part scarecrow.

Still this political power, CIO's particularly, is easy to exaggerate. Look abroad. Did not British Labor sweep Churchill from power? Behold PAC, too, seeking millions for a new campaign. And look westward. In Detroit, a labor candidate, Frankensteen of UAW, is running for mayor. If he wins, will CIO take over the city?

On close examination, Frankensteen's candidacy appears to be almost

Key man is Labor Secretary Lewis B. Schwellenbach. Will he follow through on his Labor Day warning that labor must assume the responsibility of solving its own problems in the public interest?

devoid of national political significance. Detroit has a non-partisan municipal set-up. All candidates jump into the primaries without party labels. Then the two high men run it off for mayor in the fall election—November 6 this year. The whole set-up is wide open to well-known "names." For example, Billy Rogell, a baseball player, and Gus Dorais, a football coach, got good votes for the City Council. And Frankensteen is primarily a "name," too.

The present mayor, Edward J. Jeffries, was elected and twice reelected under this system. To this day nobody knows for sure whether he is a Republican or a Democrat. He has never had to declare himself.

Frankensteen Not Real "Labor" Candidate

Labor did try to beat Jeffries two years ago with a CIO-pledged candidate, Frank FitzGerald, a federal court commissioner. The apparent importance of Frankensteen's candidacy lies in the fact that he is the first actual labor leader to stand so high politically.

But the fact is that Frankensteen is in the labor movement, rather than of it. True, he helped organize CIO and was injured in the famous "Battle of the Bridge" between strikers and plant guards in the "sitdown" days. But he is an intellectual of middle-class origin. The son of a Presbyterian choirmaster, he played football in college and has a penchant for writing operettas. Big, handsome, a fluent and persuasive speaker, he makes a personal hit with many elements.

In fact, one Detroit political expert believes that only about a fifth of Frankensteen's primary vote came from labor as such, the rest from business, white-collar, and other groups. He is running frankly not as a "labor" candidate but as a mayor "for all Detroit" and would probably lean over backward to avoid any display of labor bias in office. His candidacy did not even originate with CIO. It came about, by sheer accident, because of a speculative article in the *Detroit Free Press*.

On paper Frankensteen's chances didn't look good, even before the labor fuss began. FitzGerald had a plurality of 38,000 over Jeffries in the 1943 primaries but lost the election by 31,000. Frankensteen led Jeffries by only 14,000 votes this spring. And he won't get AFL support, nor that of the daily press.

If, despite the odds, he wins, it will not be a "labor" victory but a personal triumph for Frankensteen—an unprecedented one, too. The only labor candidate who has ever risen high in Detroit politics is Councilman George Edwards (now in the Army), a CIO intellectual who attended Southern Methodist and Harvard. He led a Yale & Towne strike, to be sure, but he is well-liked in all circles and is connected by marriage with the family of Lieut. Gen. William S. Knudsen.

Quick Reconversion Hastens Strikes

Political observers felt, in early September, that a Detroit depression would aid Frankensteen's chances somewhat. But Detroit then, despite headlines of unemployment and strikes, was in fine economic fettle.

Stores, restaurants, theaters, and barrooms were crowded (some Detroiters take pride in the claim that the city is tops in per capita consumption of beer). The evening papers carried two pages of "Help Wanted" ads daily. And there were no takers for 1000 jobs open on the Detroit police force.

True, thousands stood in line for unemployment insurance while CIO pickets urged bigger and prompter payment. Under such pressure, officials made little effort to shunt the "jobless" into lower-paid service and trade posts. And reporters, questioning "unemployed" girls on the insurance lines, found that 90 percent had no intention of returning to work at all.

The fact is that even automotive employment wasn't too bad—at least until Ford went down. Automobile production was expected to pick up in November and hit 1941 levels by the turn of the year.

Originally the real labor fight in Detroit wasn't expected much before March, 1946. The 1942 cars now building are under OPA ceilings. On these management will either break even or lose money. In March, however, gradual changes will be intro-

duced, without interrupting production, until the 1946 cars are on the lines. These will doubtless command higher prices. And this, in turn, would mean that management and labor will have a good-sized profit bone to pick.

The fact that CIO is apparently jumping the gun is one more evidence of its jittery state of mind. And, in a sense, it may mean that the automotive industry is being penalized for the alertness and speed with which it forged ahead in reconversion. At all events, the Ford layoff, resulting from the Kelsey-Hayes strike, is believed to have been a factor in precipitating the automotive strike vote ahead of schedule—another argument for local settlement of local labor problems.

Do Apostles of Fear Rule Labor Roost?

It should be made a matter of record that the big steadying force, in this most critical of economic periods, has been management. The apostles of fear have been on the labor side.

Management has had the courage to go ahead with plans, to produce, to sell, to make jobs, to issue encouraging statements. But if the public had listened only to labor in the first months after V-J Day, what would it have heard? Nothing but croaks of fear—and impossible "demands." Labor spokesmen nurtured the fear of labor warfare. They talked of an onslaught against the unions by management. They built up the bogeyman of large-scale unemployment.

Yet when a needless obstruction to reemployment like the Kelsey-Hayes strike arose, labor leadership proved futile. Moreover, UAW's President Thomas put the onus, when reproached, on management. For, said he, if management would only yield to the 30 percent wage increase demand, then UAW would have no trouble in keeping its members in line.

The 30 percent drive itself has threatened to cast a new pall of fear over the reconversion scene. Call it mere shadow-boxing for the benefit of the rank and file, if you wish. But it amounts to this: In calling for an automotive strike vote (which will cost the taxpayers hundreds of thousands of dollars) the CIO is providing itself with a loaded gun to carry into the "peace" conference for use in case other threats fail.

This maneuver may serve strategically, of course, to distract attention from another fundamental issue, namely that of a day's work for a day's pay. The worker's fear-inspired tendency to hold back on production is an age-old thing. So, too, is resistance to technological improvement. And labor leadership is adding to that fear.

Is labor's political power exaggerated? The candidacy of Richard Frankensteen, CIO leader, for mayor of Detroit, is much less significant when viewed locally than when seen from a distance

Problems Can Still Be Solved, IF—

Most sensible management men expect wage increases and other adjustments of benefit to labor. Technological advances, delayed by the war, should give new scope to bargaining for a fair division of their fruits. And they will if given a chance. But they won't, if production and sales are crippled by arbitrary tie-ups over arbitrary demands, if unions and union leaders persistently quarrel among themselves, and if labor puts its first faith in political power.

Past a certain point, political power won't work. Labor is now inviting another Congressional flare-up such as that which produced the Smith-Connally Act. Compulsory arbitration would then almost certainly result. And it is hard to believe that labor wants this any more than management does.

The real answer to today's labor problems lies not in the erection of gigantic new governmental machinery for the control either of management or labor. It lies rather in free collective bargaining between management and labor before the bar of public opinion with impartial government arbitration as a last resort. And it lies, above all, in wider recognition of the fact that labor troubles have got to be solved where they begin—*at the local level.*

Matching Conveyor and Job

WALTER F. EITEL, Supervisor of Methods, AC Spark Plug Company, Flint, Mich.

FOR GREATER OUTPUT LOWER COST

CONVEYING MATERIALS in a factory can be, and frequently is, more costly than the productive operations. This is especially true where a great variety of products are made, each with many parts, and where design change is frequent. For example, the gas and oil gages, filters, speedometers, pumps, and spark plugs manufactured by AC Spark Plug Company are assembled from many parts produced at diverse points in a large factory; therefore materials handling methods are carefully planned before productive processes are fixed in the layout.

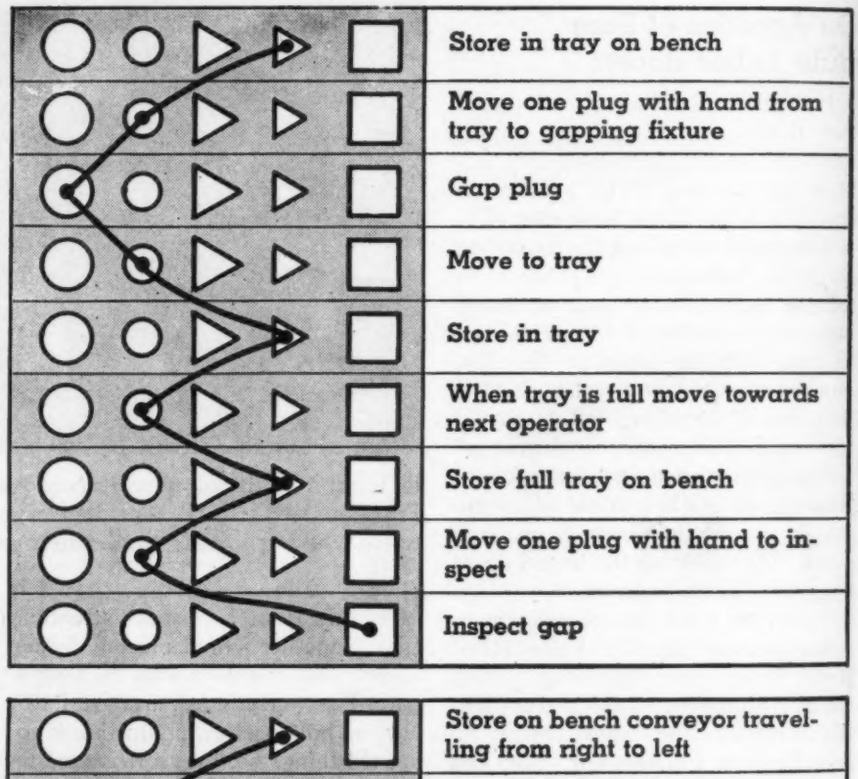
To test an existing set-up for efficient materials handling, answers are sought to the 20 questions listed on page 99. These answers are more easily found if a process chart is used. For instance, Figure 1 is a section of a process chart showing the movement of a spark plug from the gapping operation, by tray, to inspection—the trays being moved by hand. It will be noted that each plug is moved three times and stored twice between gapping and inspection. The two storages, which follow each other with no productive operation between, indicate an undesirable condition—each plug is handled twice before something constructive is done to it.

Moving by Conveyor

Figure 2 shows the same operations, using a conveyor to move a plug from one operator to the next. Here it will be noted that each plug is moved twice and stored once between gapping and inspection—movement on the conveyor between operations is considered a storage even though moving toward the next operation.

To be sure, a cost comparison between manual and conveyor handling is required before final decisions are made, but the principles of good layout, as far as materials handling is concerned, may be stated as: Manual materials handling at a minimum; the progressive movement; small banks between operations; the most economical materials handling equipment; and method of movement that fits the job.

The principle of tailoring the materials handling method to the job is illustrated by two pictures of AC Spark Plug's press department. The first, Figure 3, shows the last in a series of four presses discharging a completed part onto a moving platform conveyor. To the operator's left is a hopper with a sloping bottom which delivers the part from the previous operation always at just the right point to be grasped by the left hand. As parts come from the previous press they drop into an elevator at the back of the press which


Store in tray on bench
Move one plug with hand from tray to gapping fixture
Gap plug
Move to tray
Store in tray
When tray is full move towards next operator
Store full tray on bench
Move one plug with hand to inspect
Inspect gap
Store on bench conveyor travelling from right to left
Move with hand from conveyor into gapping fixture
Gap plug
Move with hand from fixture to conveyor
Store on conveyor; plug travels to next operator
Move with hand off conveyor
Inspect gap

Figures 1 and 2. Process charts of manual (upper) and conveyor (lower) handling of plugs. A move and a storage were eliminated

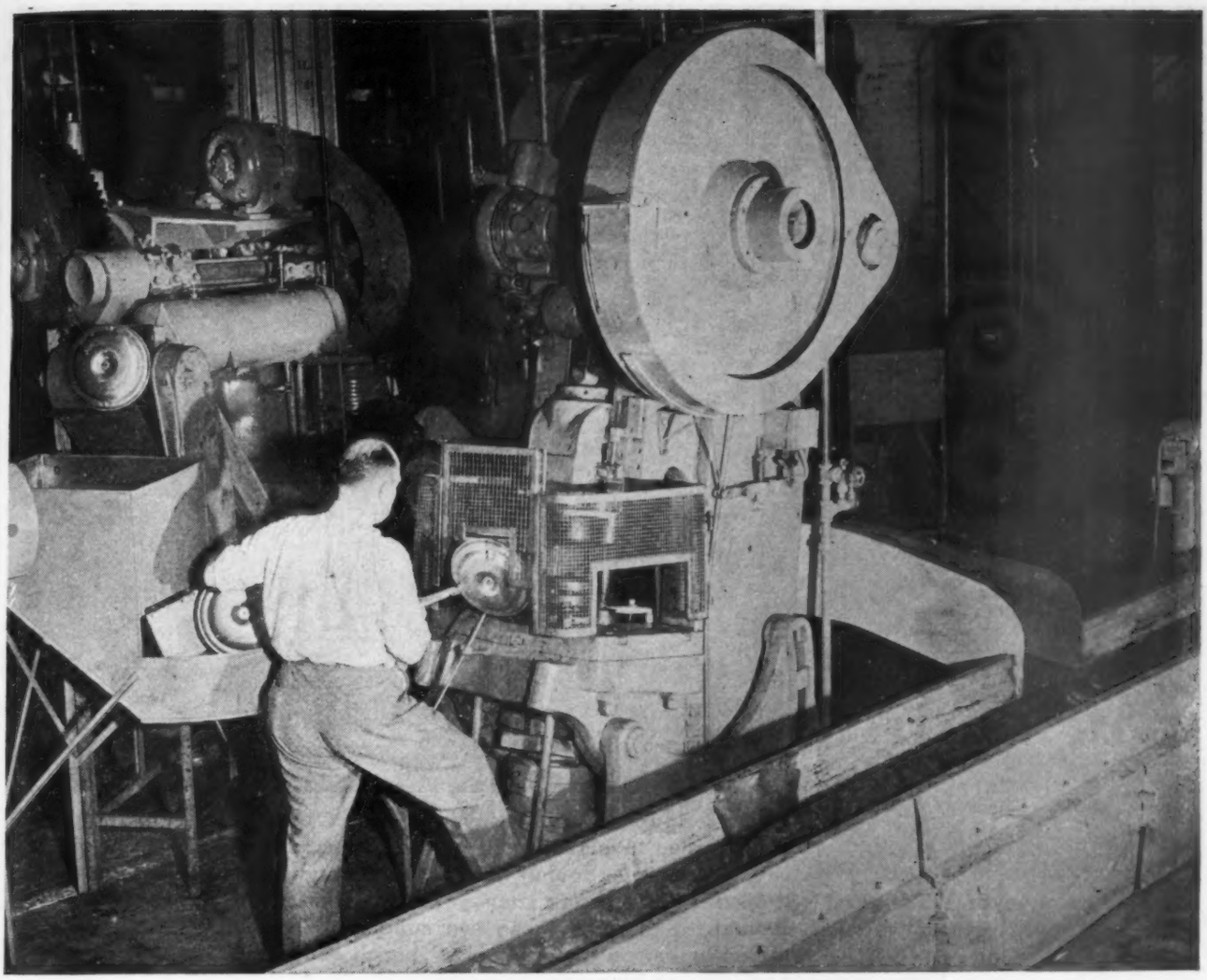


Figure 3. At the end of a series of four press operations, part is discharged to a moving conveyor. Movement between presses is by elevator and hopper. Hopper has sloping bottom which delivers the part from the previous operation always at the right point to be grasped by the operator's left hand

raises them and dumps them into the hopper. In general, this is the pattern of movement of material between successive operations in the press shop. If changes in schedules require changes in dies and parts turned out by a press line, the materials handling equipment is flexible enough to absorb the change.

Figure 4 shows two press lines discharging into a conveyor leading to a washer. This conveyor carries several different parts, all discharged to the apron of the washer, because no segregation is required at this point. At the other end of the washer, however, segregation is required; it is provided by monorail conveyors running by the end of the washer, onto which are hung the proper sheet metal parts for delivery to the appropriate departments for further processing.

The press line movement is a conveying means between operations—it fits the job. Figure 5 illustrates a similar use of a conveyor—a means of movement between operations—but the parts are small and delicate, requiring careful handling. The operator takes a gas gage frame from the conveyor just below and in front of her machine, places it in the machine, adds the dial shown in her right hand and two rivets, and rivets the dial to the frame. The assembly then goes back to the same conveyor. Some 60 operators perform 17 operations on this gage—with the same conveyorized handling between operations.

Individual Carrier Plates

The conveyor is a sprocket chain with individual carrier plates sliding on welded angle iron. The tray beside the press is used to pile parts from the conveyor if the parts come faster than the operator can handle them. Grooves in the carrier plates make for quick positioning by the operator, and protect the parts from injury.

Several uses are made of conveyors in speedometer assembly. Figure 6 illustrates conveyors, tailored for this job, which serve as banks of parts, as a carrying means from one operation to the next, and as a means of segregation between different stages in the process. The operator at the left makes a subassembly and places it on the storage conveyor at her left; the operator in the dotted dress completes a subassembly and places it on a bench conveyor moving toward the operator in the foreground, who combines these two subassemblies and places the assembly, shown in her right hand, on a second-level bench conveyor, which moves the part to succeeding operators, who add additional parts. Totepans are absent, operations are compact and close together, and the banks serve to balance operations in a progressive line and thus avoid frequent delays caused by temporary unbalance.

Further along in the speedometer

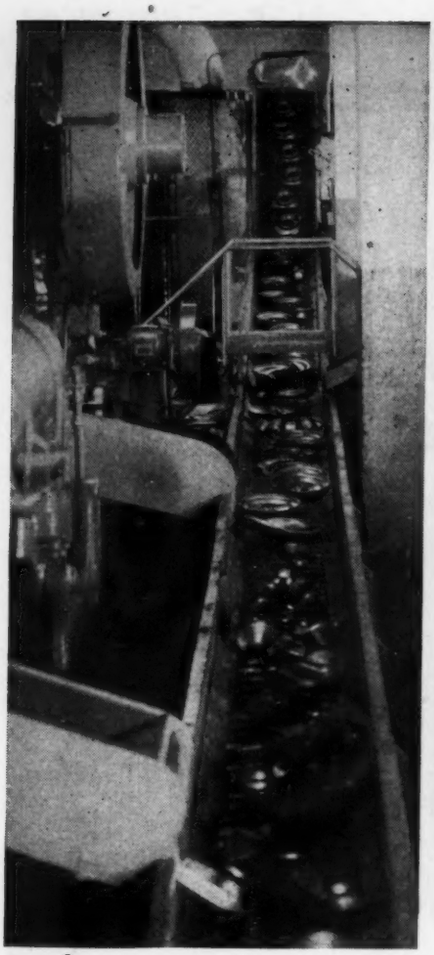


Figure 4. Conveyor takes products from two presses to the washer

Figure 6. Four conveyors converge here. Operator at far left (her hand only is seen in photograph) places her subassembly on storage conveyor. Operator facing her completes another subassembly, places it on a moving bench conveyor which passes the girl in center foreground. She takes these two subassemblies, joins them, and puts the assembly on the upper-level bench conveyor

Figure 5. Subassembly conveyor line. Operator takes gas gage from conveyor in front of her, rivets the dial to the frame, and returns the gage to the conveyor. Gage then goes on to the next operator

line, a calibration is involved. Here again the conveyor serves several purposes. It moves between operations; it holds a bank; it presents parts in convenient position for worker grasp; and it segregates and dispatches work in process.

From Upper to Lower Level

In this instance (see Figure 7), the operator removes the part from the second-level bench conveyor, calibrates it, and returns it to the lower-level bench conveyor just below her right hand. Succeeding operators take from this lower-level bench conveyor, place the assembly in the case, and return it to the upper-level bench conveyor. From this point it moves to the final inspector, shown in Figure 8. She takes the completed speedometer from the upper-level bench conveyor, gives it a final inspection, and then places accepted pieces on a monorail carrier leading to the final panel assembly line.

Figure 8 illustrates aspects of tailoring conveyors to the job not hereto-

Points to Check Before Making Materials Handling Changes

1. Can purchased material be furnished to operator in original shipping containers?
2. If not, could vendor change containers?
3. How often is material handled from receiving dock or a previous operation until used again?
4. Does operator lose much time handling material to and from operations?
5. Does this affect the line balance?
6. Are the containers best suited for the purpose?
   (a) Too large and heavy?
   (b) Too small, not enough capacity?
   (c) Difficult to pile?
   (d) Is it necessary to remove material from container and place in hopper?
   (e) Could this be avoided?
7. Would it be advantageous to have a stockman?
8. Should material be handled in lots?
9. Should material be handled in units?
10. Are trays, hangers, or racks needed?
11. Are they of proper design?
12. Does operator have to wait for stock?
13. Should chutes be provided?
14. Should a conveyor be installed?
15. For what purpose?
   (a) To supply material?
   (b) To store material?
   (c) As assembly conveyor?
   (d) A combination?
16. What type conveyor is most suitable?
   (a) Roller conveyor?
   (b) Belt conveyor?
   (c) Bench conveyor?
   (d) Monorail conveyor?
   (e) Gravity conveyor?
   (f) Chutes?
17. Should a truck be used?
   (a) Hand truck?
   (b) Power truck?
18. Is handling of scrap satisfactory?
19. Is handling of oil and compound satisfactory?
20. How often is the finished product handled until ready for shipment?

fore shown. The conveyor to the left of the operator moves between operators; now, however, an in-process conveyor meets a monorail stock conveyor, and at a point in the process where a productive operator makes the switch from one conveyor to the other as a normal part of her job. No extra cost for manual handling is involved.

Conveyor Carries Stock

The stock conveyor moving to the right of the final inspector has an accumulation of parts from the paint and spray department, and the inspector places the completed speedometer on a tray of the carrier. This stock conveyor is just that—it moves by the ends of progressive subassembly lines in many parts of the plant, picks up the completed parts, and delivers them to final panel assembly on the same floor, or upstairs to service packing. The canopy welded to the frame of the carrier protects parts from oil and grease from the chain and monorail.

Figure 9 shows the next step in the process—the final assembly of an in-

Figure 7. Operator takes assembly from upper-level bench conveyor, calibrates it, and returns it to the lower-level bench conveyor which carries it on to succeeding operations

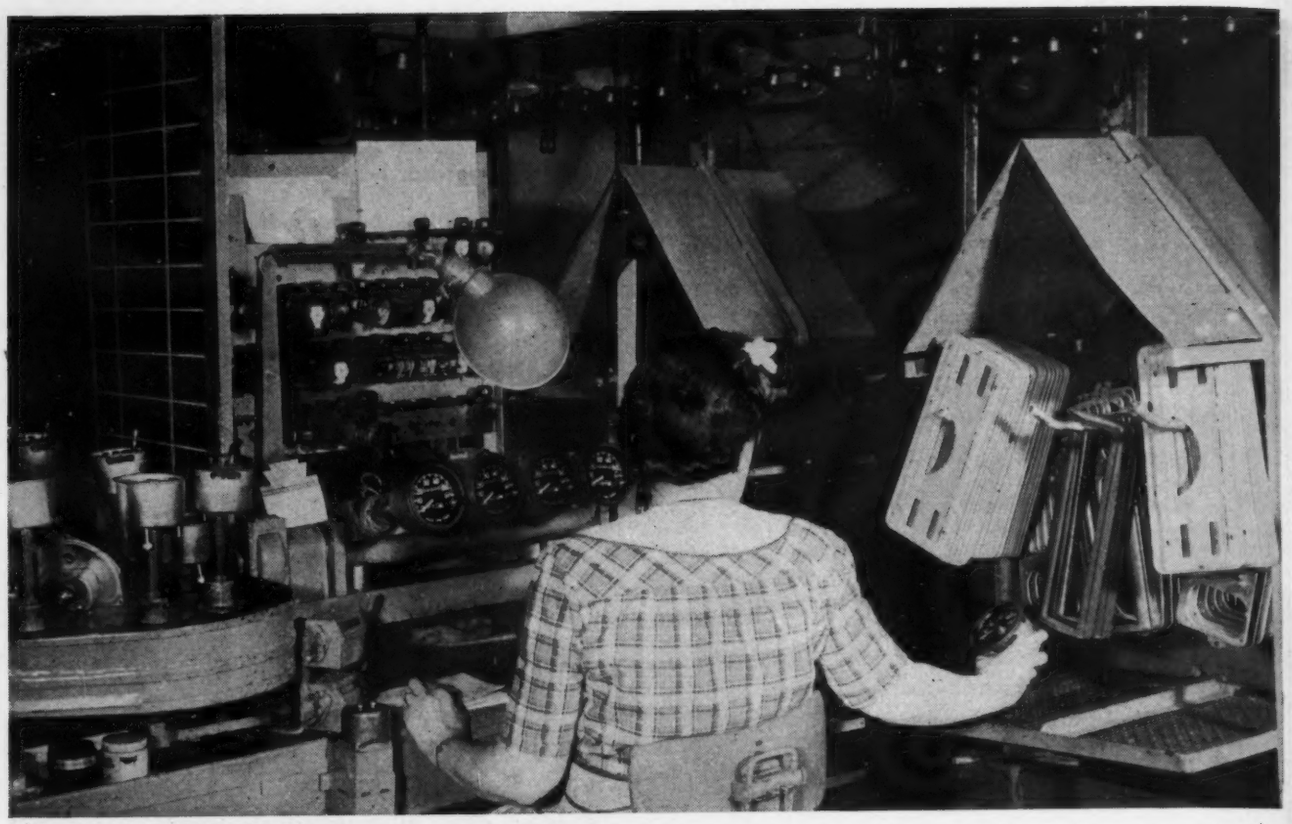


Figure 8. Final inspector gets her work from one line—a bench conveyor—and transfers it to another —a monorail to final assembly

Figure 9. Final assembly stations are served by both monorail and bench conveyors. Operator gets instrument from monorail, places it in the case on bench conveyor. Next operator fastens instrument without removing the panel from the bench conveyor

strument panel. The operation illustrated is typical of 28 at this point in the process. The monorail with trays running in front of the operator collects completed components from the parts lines and delivers them to this assembly position. There are about 360 carriers on this line, and it takes 2½ hours to make a complete circuit.

Serving Final Assembly

Two monorails serve this final assembly line. One, from the press and plating room (not shown) delivers the sheet metal frame into which the instruments are placed; operators take the frame, add parts to it, and place it on the bench conveyor passing in front of the operator in Figure 9. The second monorail, shown in the picture, brings completed subassembles from the ends of component lines. The operator takes these subassemblies from the trays as they pass by, adds parts, and then places the completed units into the frame moving by the opposite side of the narrow assembly bench. Each frame, face, and case assembly has an individual carrier. Succeeding operators fasten assemblies to the frame.

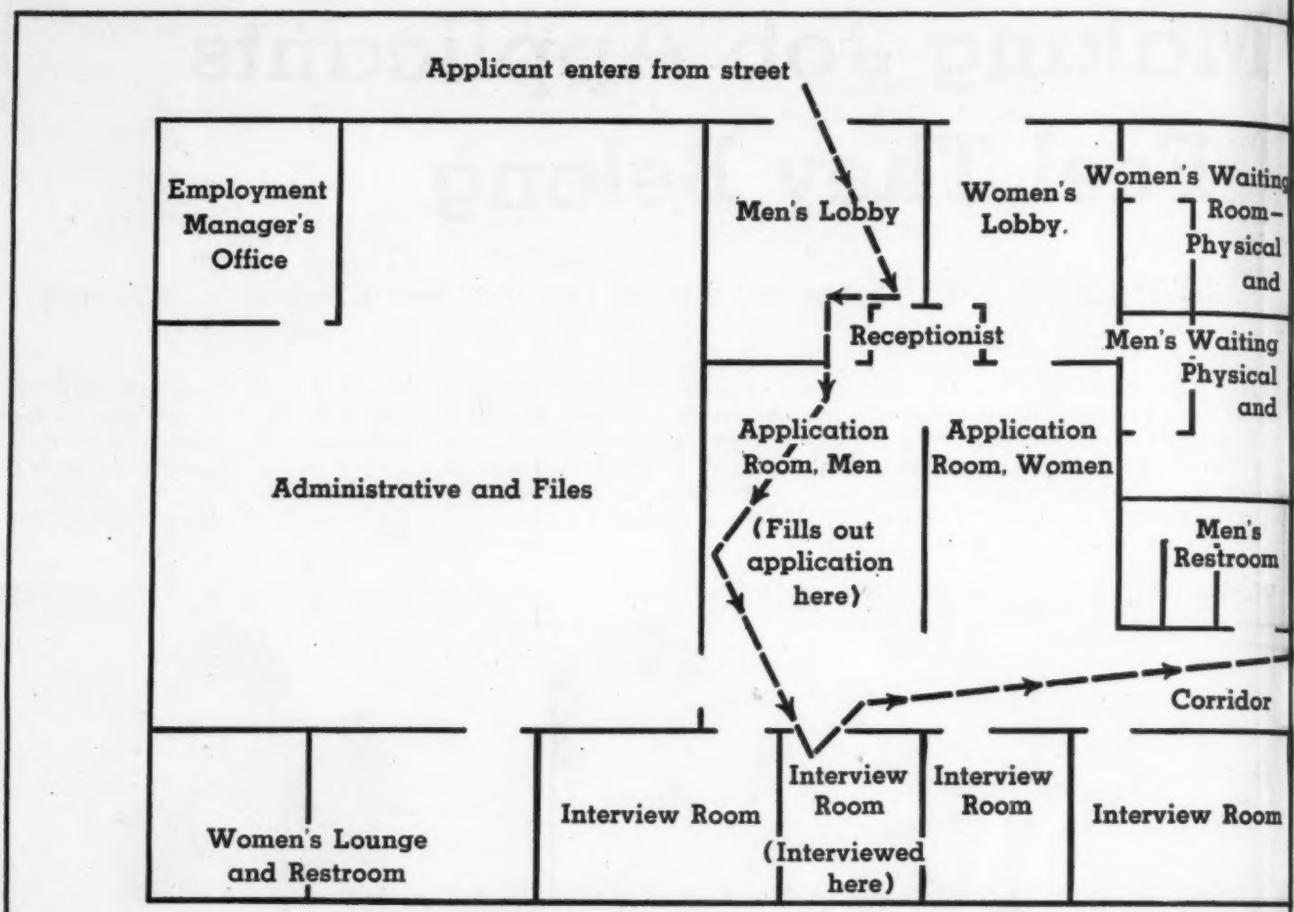
Making Job Applicants Feel They Belong

STANLEY R. KUHNS, Personnel Manager, Cleveland Works, Aluminum Co. of America

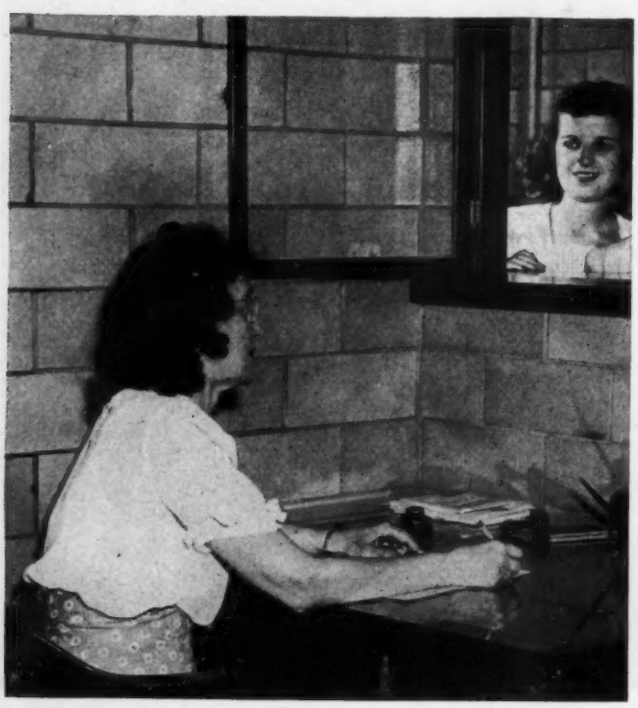
FIRST IMPRESSIONS of a company are so likely to be lasting in the minds of job-seekers that the Cleveland Works of Aluminum Company does everything it can to make sure that those first impressions are good. The employment office is therefore arranged, and the hiring procedure set up, to accord every applicant the attention and courtesy he merits as a possible future member of the Alcoa family.

Ideally, a prospective employee should be taken through the induction procedure on a straight-line, in-one-end, out-the-other route. The proximity of long-established production units at this Alcoa operation, however, posed the problem of cutting corners within

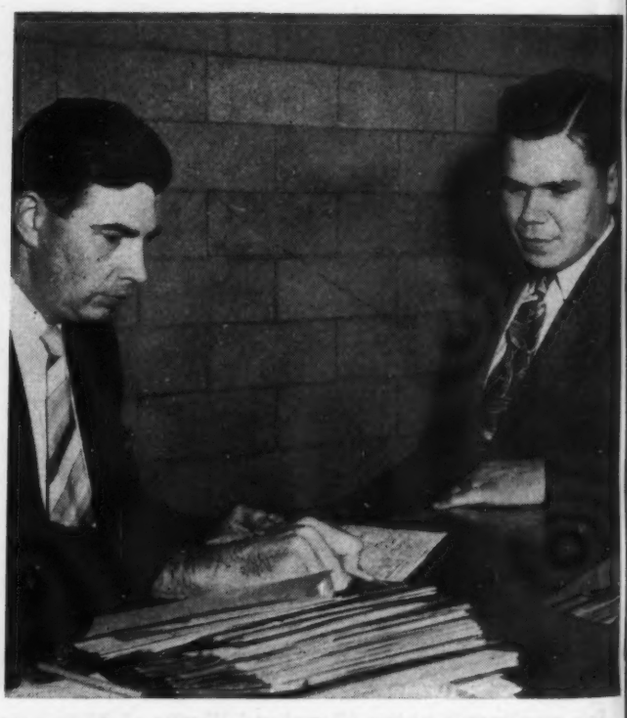
Job applicants at the Cleveland Works of Aluminum Company of America are prospective members of the Alcoa family—and are treated as such from the moment they walk in the front door of the plant



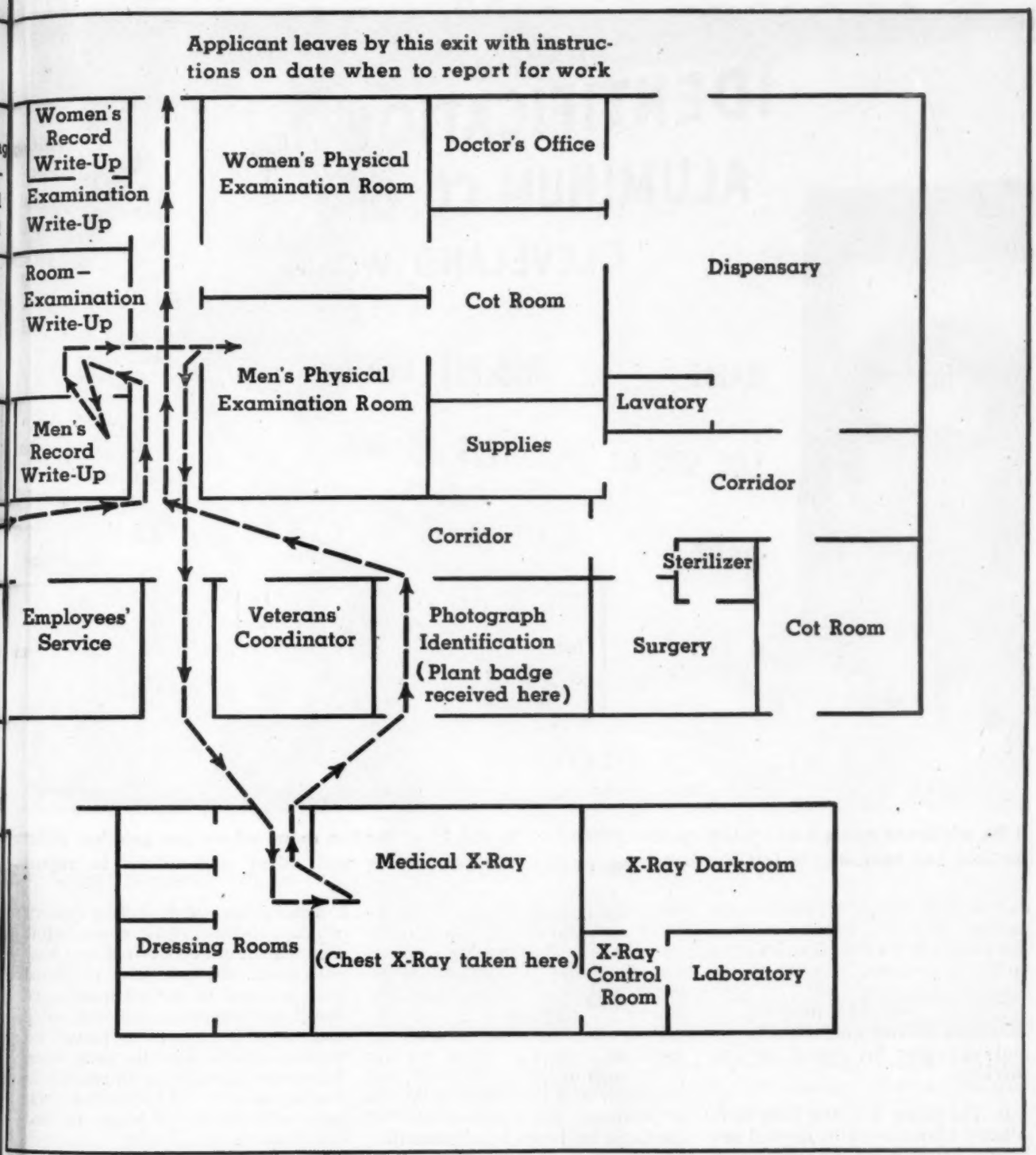
EMPLOYMENT OFFICE
Cleveland Works, Aluminum Company of America



Receptionist greets job-seeker, examines credentials, notes name, admits her to application room



Prospective employee outlines his experience in the complete privacy of one of the interviewing rooms



approximately the same space available before expanded capacity necessitated an accelerated hiring program. The solution to this puzzler, which has since proved itself a confusion-eliminator and time-saver both for employment office personnel and for applicants for foundry, forge plant, laboratory, and office posts, involves these seven main steps from entrance to exit:

1. The applicant enters directly from the street through a divided doorway, with separate entrances to the office's male and female divisions. A receptionist examines the job-seeker's credentials, notes his name, then admits him to the application room just within the lobby.

2. Here the applicant is directed to a tablet armchair, provided with pencil and application blank, and, upon completing the form, is referred to an interviewer.

3. In the complete privacy of one of the interviewing rooms, which range along one side of the application room, the prospective employee outlines his previous vocational experience. He is then advised of openings for which he might qualify, union agreement provisions which would concern him, and company policies and regulations affecting employment.

4. If the applicant desires a job for which he appears qualified, his next step takes him to the nearby physical examination waiting room. Here, as he awaits the attention of the medical

If the applicant meets the physical qualifications for the job, her next step is into the adjoining photograph identification room, where she gets her plant badge, and is told when and where to report

director, his record of previous experience, plus other essential information elicited by the interview, is written up for file purposes.

5. Across a corridor from the examination waiting room, the applicant undergoes his general physical check-up.

6. The taking of a chest X-ray in an adjacent laboratory of the medical center completes his physical examination.

7. If the applicant has met physical qualifications for the job he seeks, he steps into the adjoining photograph identification room, receives his employment credentials and instructions as to where and when to report for work, and then steps directly out to the street through an exit door located only a few feet from the employment office entrance.

While necessarily compact, this Alcoa induction route enjoys a major advantage in that its closely coordinated units can easily be kept under surveillance at all points. Any tendency toward a bottleneck can quickly be detected, and eased before it can grow into an irritating jam-up.

Even when out of work, the average American is quick to resent any lack of attention or waste of his time, and management of the Cleveland Works is convinced that emphasis on this one factor has bred a lot of goodwill.

During the short waiting periods which sometimes must ensue before an applicant can be received by a busy interviewer, the newcomer is offered current issues of the company's national and Cleveland employee publications. This gesture has proved extremely popular, since the prospective job-seeker naturally is interested in reading of activities within the company with which he hopes to find employment.

THE AMERICAN WAY

Scientific progress and productive efficiency are the most wonderful weapons of all time because they do not have to be laid aside when the fighting ends. *They must not be laid aside.* Industry and labor, with the full cooperation of our government must begin at once to apply them to the problems of peace and reconstruction. I believe we are ready to do that today. *C. E. Wilson, President, General Electric Company*

Training in Management for Supervisors

CHARLEY H. BROADED, Supervisor of Management Training, Ryan Aeronautical Company, San Diego, Calif.

"We feel that it would take years of ordinary shop experience to get the grasp of management principles that this course gives in 20 hours." That is the way supervisors sum up the benefits they have derived from the management training course given at the Ryan Aeronautical Company. This course now accomplishes as much in a 20-hour course as, two years ago, was accomplished in 80 hours. This result has been achieved by doing three things: (1) Eliminating every bit of extraneous material from the course; (2) organizing the course in logical sequence; and (3) using visual aids such as charts and posters to illustrate points.

The primary objective of the management training program is the development of competent supervisors at each level throughout the organization, because the supervisor is responsible for the efficiency which his unit achieves. By "supervisor" is meant any person who is directing the work of others.

What Supervisors Need

At all levels of supervision there is required, first, technical job skill; second, instructional ability; third, improvement of production methods; fourth, satisfactory employee relations; and, fifth, adequate job management.

The skill to do superior mechanical work does not necessarily imply an ability to impart this "know how." Failure in this phase of supervision is often summed up nicely by some such remark as "Oh! Jim knows his stuff all right, but he just can't tell anyone what he wants." However, if the craftsman knows how to instruct others easily and efficiently, he has mastered the second phase of supervision.

A competitive free enterprise economy requires each manufacturer or producer to become as efficient as possible. Therefore, scientific management is being applied to most production jobs. The supervisor is expected to improve processes and methods so that maximum efficiency is achieved from both men and equipment. This requires a knowledge of the principles of work simplification and the application of job-improvement methods.

In the Ryan Aeronautical management training course specially designed visual aids—posters, charts, and moving pictures—are used to obtain the maximum learning in the minimum time

Both in teaching and improving processes, the supervisor is constantly dealing with people. His over-all job success depends upon his ability to maintain harmonious personal relationships with his supervisors, his coworkers and his subordinates.

At the Ryan Aeronautical Company, fifteen supervisors are in each group. Sessions number approximately twenty. A varied approach to teaching the subject material is used. A few sessions are conducted by lectures, some by directed conferences, and some are conducted as pure conferences. Film strips, moving pictures, charts, and other specially designed visual aids are used to obtain the maximum learning in the minimum time.

Follow-up work is conducted by each management trainer with members of his group for the solution of actual shop problems. The effectiveness of the application of classroom teaching is greatly increased by this

technique. If a problem involves other departments, this fact is brought to the attention of the department foreman concerned. By a tactful and diplomatic approach, many problems involving horizontal coordination can thus be eliminated.

Especially prepared pamphlets covering the subject material of each conference are given to group members at the end of each session. They can then review the material and bring up any questions in the next session.

Following is a brief resumé of some of the conferences included in Ryan management training. Subject material is always adapted to the group level.

Planning. The supervisor is shown that the efficiency of his department is no better than the planning which he does. The factors of successful planning are presented and the technique of making detailed plans for various activities is amply illustrated by the use of case examples, films, and charts.

Organizing. The provision for, and the arrangement of, people necessary to carry out the functions established by planning, requires that the supervisor not only knows but understands the principles of organization and so sets up his group that each person has (1) one boss, (2) correct span of control, (3) a homogeneous list of duties, and (4) the authority required to carry out the assigned responsibility. Line and staff functions must be well understood and the duties and responsibilities of each person within his department must be clearly defined to prevent overlapping or blank spots within the group.

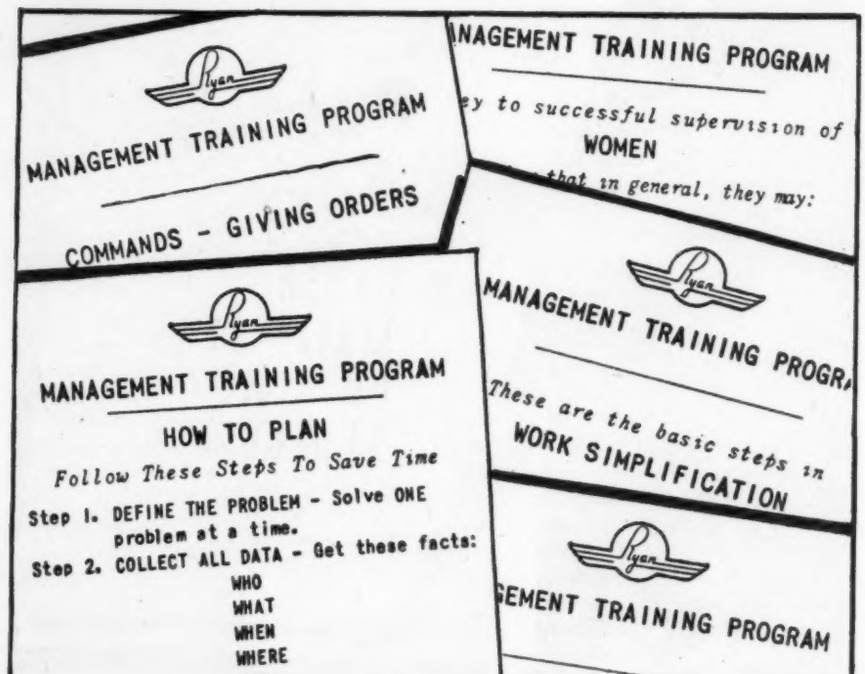
Commanding. To be successful, people require direction. This must be accomplished by leadership. A supervisor must know how to motivate his people by means of clear-cut, complete, and positive orders. He must be able to tell without antagonizing, and recognize that it is his job so to design his orders and requests that he gets people to do things because they want to rather than because they have to. He must use the correct method of transmitting orders so that confusion, loss of time, and failure on the part of his subordinates are eliminated.

Controlling. The supervisor is the manager of his department, and he is responsible for the efficiency of the work accomplished and the rate at which it is performed. To control quality, quantity, and costs requires him to use the suitable control techniques. His knowledge of standards and his ability to develop special controls help in assuring that production schedules will be met.

Coordinating. Unless the right material, equipment, and trained technicians are at the right place at the right time and in the right quantity, some degree of failure will result. The successful execution of the coordinating function requires good planning, proper organization, effective commanding, adequate controls, and some additional techniques. These techniques involve the supervisor's use of staff meetings, control conferences, properly designed and routed interoffice memos, directives, and procedure sheets.

Budgeting time. How the supervisor utilizes his time can be used as a criterion for determining his value. He must be thoroughly aware that his job requires the development of subordinates to carry out the functions of the department. Since every supervisor has just so much time available, he must manage his use of this time to accomplish as much as possible by being sure that he is continually getting the most important things done first.

Building confidence. The foundation for good personal relations between the supervisor and his subordinates must be built upon mutual confidence. Unless the supervisor makes himself an "easy to talk to" person, knows the hobbies, likes and dislikes, hopes and ambitions of his people, he will be unable to establish confidence. He must also "know his stuff," keep his promises, believe in the ability of other people, and merit respect before he can obtain the willing cooperation of his group.


MANAGEMENT TRAINING PROGRAM
COMMANDS - GIVING ORDERS
MANAGEMENT TRAINING PROGRAM
HOW TO PLAN
Follow These Steps To Save Time
Step 1. DEFINE THE PROBLEM - Solve ONE problem at a time.
Step 2. COLLECT ALL DATA - Get these facts:
WHO
WHAT
WHEN
WHERE
WHY
Step 3. CLASSIFY THE DATA - Group the factors which help or hinder the plan or problem.
Step 4. WEIGH THE DATA - Eliminate unnecessary steps. Set priorities.
Step 5. MAKE A PROPOSED PLAY - Based on facts above.
Step 6. TEST THE PLAN - Put it to work, but follow up and
Step 7. REVISE IF NECESSARY - By applying these steps to eliminate trouble.
A successful supervisor takes time to plan his work.
2.
MANAGEMENT TRAINING PROGRAM
WOMEN
MANAGEMENT TRAINING PROGRAM
These are the basic steps in
WORK SIMPLIFICATION
MANAGEMENT TRAINING PROGRAM
REPRIMAND
MANAGEMENT TRAINING PROGRAM
You Need
COOPERATION

Pamphlets covering the subject material of the conference are given to group members at the end of each session. They can then review the material and bring up questions at the next session

Inducting new employees. At the Ryan Aeronautical Company it has been found that the first 30 days on the job is a critical period for every new employee. How he adjusts to the company is largely determined by his attitude toward his immediate superior. A specific step-by-step technique which has proved adequate in thousands of cases is used to show the supervisor how the new employee must be treated if long-lasting amiable relationships are to be developed.

Reprimanding. The supervisor's responsibility in correcting his subordinates' mistakes is stressed. The proper method of doing this does not cause irritation, resentment, or ill feeling. By following the correct technique, the subordinate is treated fairly, encouraged to do better, and shown how to prevent a recurrence of the original mistake.

Developing initiative. The necessity for developing initiative in subordinates and its value to the supervisor are emphasized. A definite step-by-step process which always works is demonstrated. Members put this into practice and report results at later conferences.

Handling grievances. "Gripes" and grievances must be handled as close to the source of origin as possible. The employee's immediate superior should prevent minor irritations from becoming genuine problems. Unsolved grievances have a tendency to grow and become major causes for absenteeism, turnover, and so forth. The necessity for eliminating any repercussions is the responsibility of the supervisor. A definite, proved technique for maintaining a smooth-running department is presented. Each conference member then applies this technique to some sample grievances and presents his solution to the group.

Getting cooperation. The supervisor's ability to get cooperation from his superiors, co-workers, and subordinates is a large factor in his success. The importance of this cooperation is stressed, and the techniques to be used are presented. They include the presentation of properly compiled, tabulated, and graphically presented information to the superior. The approach to the problem is from the viewpoint of the co-worker and with the subordinate considered as an individual—not just a clock number.

Women on the job. Some supervisors still consider women workers to be problems instead of workers and, consequently, have difficulty supervising them. At Ryan, the film "Women in Industry" is used as a basis for pointing out the minor differences involved in supervising men and women.

Charts and posters are used to explain to each group what the staff departments do, and how their services can be obtained. A supervisor's failure to take advantage of the services offered by these departments cannot but result in some degree of inefficiency

Work simplification. Each supervisor must have the ability to apply work simplification and energy-saving techniques to production processes if his company is to compete successfully with its rivals. Two conferences are required to develop principles whose application will eliminate cross-travel, backtracking, and inefficient work methods. "Effective working area" is demonstrated by specially built benches, racks, and jigs.

Developing an understudy. Many American manufacturing concerns have recognized the folly of obtaining personnel for key positions from their competitors. This conference is designed to point out the benefits to the company and the supervisor of training a subordinate. Definite procedures which have proved successful are discussed, and conference members who are in line for promotion use them in developing someone to fill their positions.

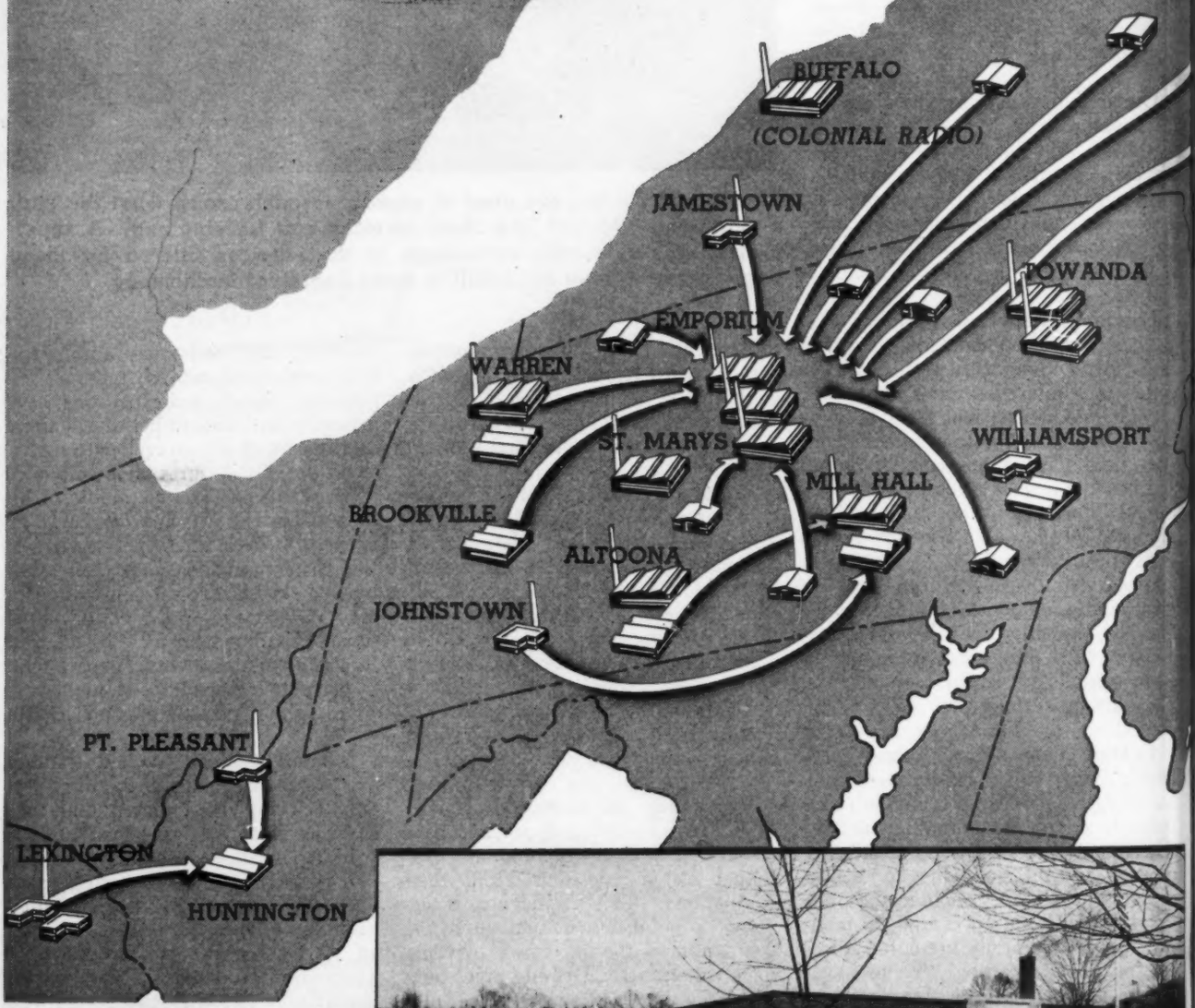
Functions of staff departments. Staff departments, such as employment, inspection, wage and salary administration, production control, methods engineering, liaison, and expediting, have necessary functions to perform. Failure on the part of any supervisor to understand the relationships of these service departments to the functioning of his unit will result in some degree of inefficiency. To utilize their services to the maximum, the supervisor must have a knowledge of these departments, what they do, and how their services can be procured. The required information about these departments is given to each group of supervisors by means of specially prepared charts.

Teacher training. When leadmen are given management training, considerable emphasis is placed upon their learning how to instruct others. In learning to teach, they demonstrate the proper technique by using actual shop jobs. As more and more supervisors have taken the course, the value of its teachings have become more pronounced. In the lower levels of supervision (leadmen and group leaders), the time required to break in a new man has been cut 50 percent over the former period. Also, there is a more cooperative attitude among plant employees because each of them has a greater understanding of the other fellow's job.

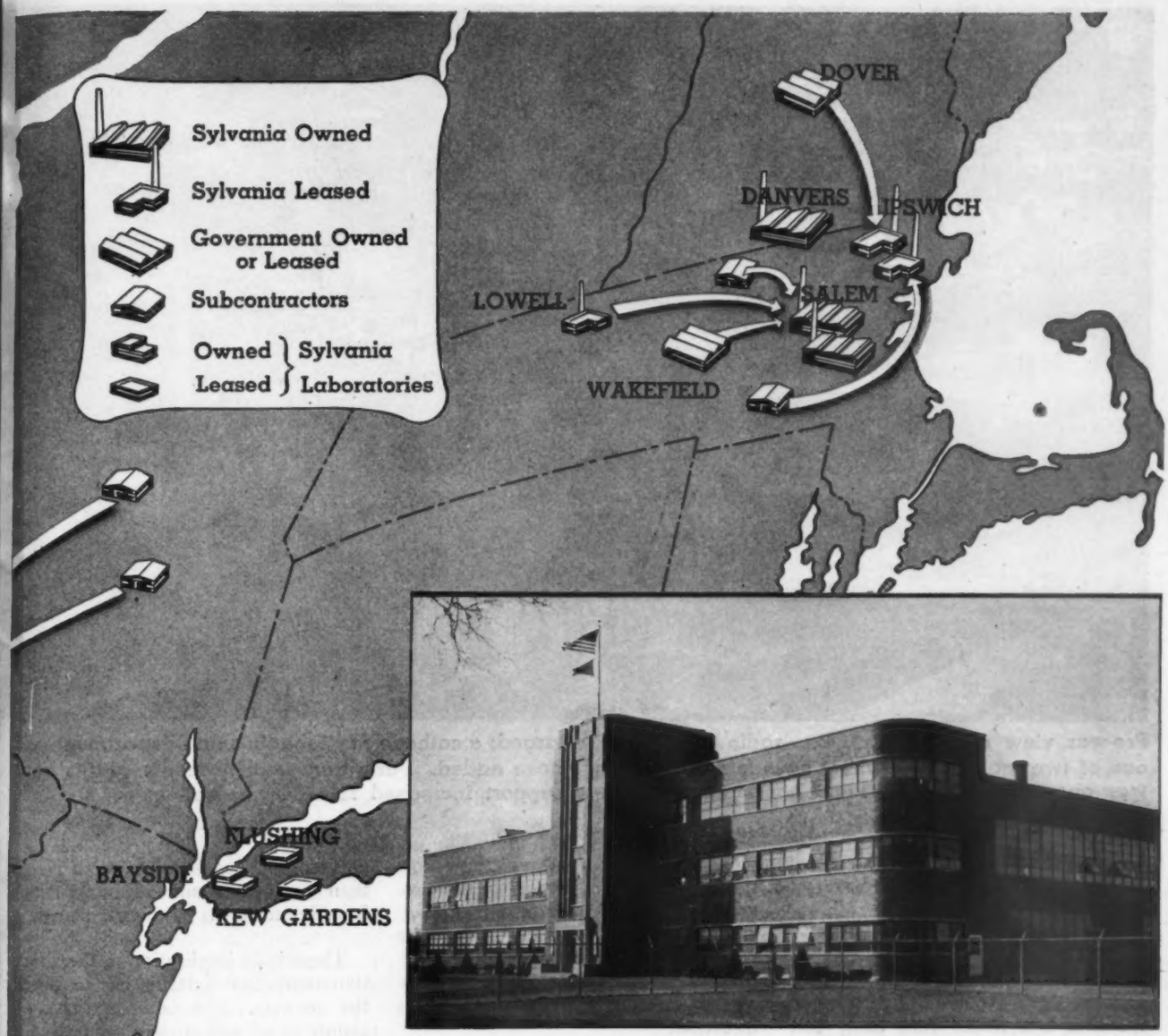
Sylvania—a Case Study in Decentralization

LEWIS K. URQUHART, Managing Editor, *Factory*

Feeder-plant system of small plants in small towns, conceived before the war and put to the test in four long years of wartime expansion, provides the blueprint for low-cost peacetime operation



Typical feeder plant in Sylvania system is the wire product plant at Warren, Pa. Parts made here are used at the Salem and Danvers, Mass., and the St. Mary's, Pa., plants where lamps are assembled



Fluorescent lamp plant at Danvers, Mass., was set up in 1941 when both the incandescent and fluorescent divisions in Salem were operating to capacity. Here fluorescent lamps are made complete, from applied research to marketable product. Parts come from feeder plants in Dover, N. H., and Lowell, Mass.; fixtures from nearby Ipswich

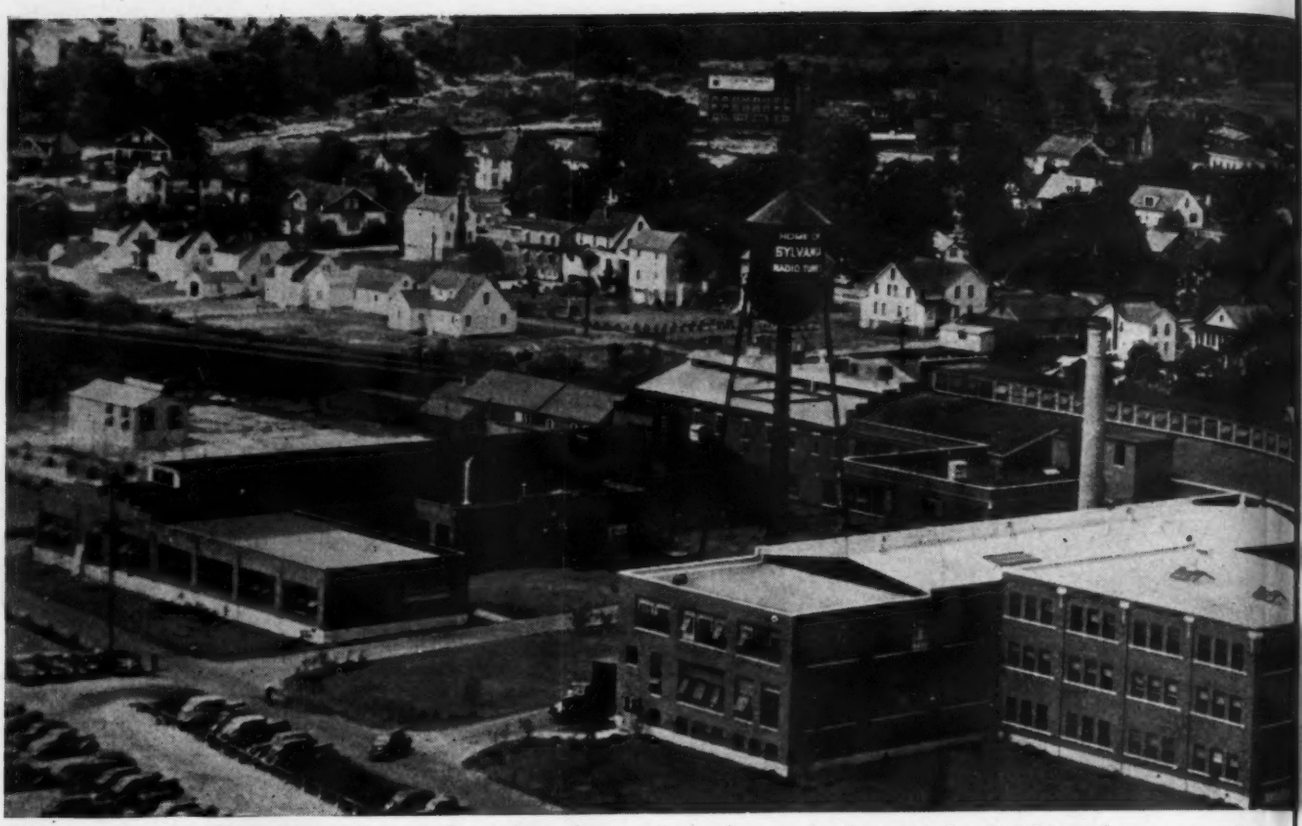
YESTERDAY'S PLAN to build small plants in small towns is, for Sylvania Electric Products, Inc., the blueprint for tomorrow. Conceived long before Pearl Harbor and brought to swift maturity by four years of wartime expansion, it now points the way to low-cost peacetime operation. (This long-time policy of decentralization paid its fattest dividends when Sylvania undertook the production of a hundred million tubes for the radio proximity fuse used so effectively in the closing months of the war. In no other war could the company have scraped up the manpower required for this tremendous job.)

For a good many years most of the company's production was concentrated in two plants. Decentralization has resulted in the establishment and operation of more than a score of feeder plants in small towns and rural areas. The accompanying sketch presents the picture pretty much as it was earlier this year. It shows main plants and some feeder plants, as well as some plants owned and operated by subcontractors. The end of the war has necessarily forced a few changes, but the blueprint remains substantially the same.

The map does not attempt to show all interplant material flow. Nor is it intended to portray all small plant relations to main plants. But it does show the location of major production facilities—and the pattern of decentralization this company is following. To Sylvania, in short, decentralization means the removal of certain production units from a main plant to small, so-called "feeder" plants. It also leads to the development of other nuclear "main" plants which utilize part of the feeder plant output and function much like the parent plant.

Benefits to Workers

From the worker's point of view, this breakdown of the company's products into units that can be produced in small plants in small towns,



Pre-war view of Emporium, Pa., radio tube plant, one of two main plants where Sylvania production was once concentrated. Plant has since been enlarged; a cathode ray tube finishing department has been added. Parts from nearby feeder plants now support increased finishing operations

brings distinct advantages which may be summarized as follows:

1. The lower living costs that obtain in small uncongested towns mean substantially higher *real* wages.

2. Workers are able to live at home, are thus not forced into badly congested metropolitan districts.

3. Lengthy, tiring, and expensive commuting is eliminated.

4. There are more opportunities for advancement in a company with 20 plants than in one with 2 plants.

5. Most small-town workers own their own homes, can use their spare time—even occasional layoff periods—in farming, carpentering, and painting, not to mention fishing.

6. Shop foremen and production supervisors in small plants employing 1000 people or less acquire a sense of personal accomplishment they could never hope to come by in an urban plant with 20,000 employees.

Benefits to Company

Although the advantages of decentralization to the workers and to the company are necessarily closely interwoven, it is possible just the same to pick some of them out and show how the "nuclear" and feeder plant program works just as certainly to the advantage of the company as to the worker. Among the following achievements lie most of the reasons that drew Sylvania, as far back as 1935, in this direction:

1. Small-town operation enabled the company to tap new sources of labor supply.

2. Citizens of small communities show greater interest in their work, and hence *do* better work.

3. With this kind of help, fewer rejects are found among parts going into final assemblies.

4. Industrial harmony is best when the plant manager knows every worker by his first name—and *vice versa*.

5. Small-town workers are less inclined to absent themselves without cause.

6. Small plants offer greater incentives to maturing workers, the company has been able to develop a more effective executive personnel.

7. It proved easier, under wartime operating conditions, to transport truckloads of partially finished products from feeder plants to main plants than to move trainloads of workers from home towns to distant plants.

There is no implication in the above statements that Sylvania has found all the answers. The company lays no claims to an industrial utopia. But it does feel that, for its particular set of conditions, it has found the blueprint for peacetime operation. With the aid of government financing for war production, 23 plants were put into operation, in addition to about the same number of subcontractors' plants, many of which were actually set up by Sylvania production men, using Sylvania tools and equipment. Of the 23 plants, only two are wholly owned DPC plants. It may truly be said that the move toward decentralization was accelerated by the exigencies of war production, but it all stems back to pre-war plans to take advantage of the superior workers that the smaller communities have to offer and the increased production and improved products that result.

Before the war the company operated mainly in two centers. Incandescent and fluorescent lamps were produced in a large plant at Salem, Mass. The manufacture of radio receiving tubes was concentrated in another

Decentralization Formula

Sylvania's program for expansion is as simple as this: The company doesn't add wing after wing to, say, its parent radio tube plant (shown here as it looked before the addition of a cathode ray tube finishing department). Nor does it build new plants in the same communities, thus putting a severe strain on local labor supply and housing facilities. Instead it pulls parts and subassemblies out of the finishing plants and sets them up in "feeder" plants located a short truck haul away. The customary procedure, whereby the workers have to go where the plants are, is thus reversed. The plants are taken where the workers are

large plant at Emporium, Pa. As available manpower began to dry up with the beginning of the war, the company faced the problem of whether to add wing upon wing to existing plants, thus overtaxing labor supply, housing, and recreational facilities, and making it necessary to import and house labor, or to expand through the system of decentralization it had been developing over the past several years.

Specifications for the establishment of "nuclear" main plants, as set down in 1939, called for small cities and towns with populations of 50,000 or less, located near an arterial highway and airport. For towns in which to establish feeder plants, the company looked for smaller populations with similar transportation facilities but located within overnight trucking distance of a main plant.

Main plants were designed to produce the finished incandescent or fluorescent lamps, radio tubes, circuit equipment, etc. Feeder plants were to concentrate on the production of parts, subassemblies, and similar specialized processing of raw materials.

How the Plan Works

For example, when it became apparent in 1941 that both the incandescent and fluorescent divisions at the Salem plant were operating at full capacity, fluorescent production was removed to a new plant in Danvers where fluorescent lamps were finished complete, from applied research to marketable product. This subdivision simplified both the incandescent and fluorescent operation, and had an inevitable tendency to develop specialists in each field. Previously separate plants had been established at nearby Ipswich to manufacture fluorescent fixtures.

Feeder Plants Set Up

Feeder-plant operations for making electrical accessories for fluorescent fixtures were then lifted from the Danvers and Ipswich plants and established in an individual plant at Lowell, Mass. This move was followed by the erection of two plants at Towanda, Pa., one to specialize in the processing of wolframite ore into tungsten wire products, and the other, a chemical plant, to produce fluorescent coatings for lamps. In still another step toward simplification, a plant was established at Warren, Pa., for the manufacture of wire products. Products of all these feeder plants are combined at Salem, Danvers, and St. Mary's, Pa., where the finished fluorescent and incandescent lamps are produced.

Radio tubes require more assembly operations than lamps, thus necessitating an even greater number of feeder plants and specialization of parts manufactured. Also, plans for decentralization of radio division facilities were greatly accelerated by American, British, and Russian demands for tremendous quantities of radio and radar equipment which had never before been manufactured on a mass production basis. Thus the plants that originally developed and manufactured tubes, operating as self-contained, vertical-production units, had to be supplemented with many horizontal units in order to keep step with mounting demands.

It was, therefore, logical to set up individual plants for the production of parts and their assembly into mounts. Metal and mica parts, cathode, grids, plate, and shields, which comprise the tube mount, all have to be assembled in a slow hand operation. It takes ten or twenty girls to make these parts which one or two girls then exhaust and seal on high-speed automatic machinery in the satellite or main plants —a fact which made decentralization possible and practical in the radio division. Only through many feeder plants could parts production hope to keep pace with the high-speed automatic machinery used in the finishing operation.

New Labor Sources

Perhaps the most important motive behind the plan to decentralize was the desire to tap new sources of high-grade workers—a group that would possess the high degree of manual dexterity necessary to this type of light manu-

ADVANTAGES OF FEEDER AND

Benefits to Workers

1. The lower living costs that obtain in small uncongested towns mean substantially higher *real* wages.

2. Workers are able to live at home, are thus not forced into badly congested metropolitan districts—and slums.

3. Lengthy, tiring, and expensive commuting is eliminated.

4. There are more opportunities for advancement in a company with 20 plants than in one with 2 plants.

5. Most small-town workers own their own homes, can use their spare time—even occasional layoff periods—in farming, carpentering, and painting, not to mention fishing and hunting.

6. Shop foremen and production supervisors in small plants employing 1000 people or less acquire a prestige and sense of personal accomplishment that they could never hope to come by in an urban plant with 20,000 employees.

Small-town workers enjoy both country life and city incomes: this one helps out on the farm during her spare time

facture. Long before the war, the company discovered that such workers were hard to find in congested metropolitan areas. Generally speaking, they were not engaged in, and not particularly interested in, factory work.

Sylvania found that this potential rural worker is usually a high-school graduate, has keener eyesight, is more concerned with doing a good job and keeping that job, possesses a higher intelligence, and thus makes a better worker in skilled and semi-skilled trades than does his metropolitan counterpart. Highly individualized, interested in hunting, fishing, gardening, civic activities, and home life, this worker is more hopeful of rising to an executive position.

He is usually a happier person and thus a more efficient worker than his city cousin. He will stay with a company only when he feels there is an opportunity to advance steadily. He is reluctant to move into industrial areas.

These small-town workers can use spare time and layoff periods to good advantage. Since many are girls living at home, farmers, carpenters, garage mechanics, etc., they are not completely dependent on the plant for a living. Their contentment is well borne out by the fact that the company has had excellent labor relations, which may be at least partially attributed to the fact that a production supervisor or shop foreman in a town of 5000 enjoys a position and respect that would quickly become lost or buried in a big-city plant employing 25,000 workers. Also, it has been Sylvania's experience that the production supervisor who golfs or fishes or plays poker with his men gets along more harmoniously at his job.

Woman's Work

The manufacture of radio tubes requires a high degree of manual dexterity. For this reason, women with their natural talents for handwork prove highly adaptable to the radio tube and lighting industries. Their nimble fingers, and the speed and ease with which they handle such minute objects as cathodes, grid wires, plates, and lead wires, make them far more valuable than men. In fact 65 percent of Sylvania's peacetime personnel is made up of women. (With the scarcity of men during the war, this percentage ran over 70.)

Personnel departments of the company soon discovered that many women prefer only summer or part-time work. The older women who live at home with their husbands were found to be glad to work and apply themselves to aiding the war effort provided they could work in a factory and still manage their homes—all of which constitute just one more good reason for locating plants in small-town areas.

The feeder-plant system permits the breaking up of production so that a couple of hundred girls who are friends and neighbors can work together within walking distance of their homes. For example, in the Smethport, Pa., plant, 100 girls are engaged exclusively in mica processing. For the most part, the girls in this plant are of high school age, and the simple steps in the operation—slitting, gaging, punching, eyeleting, and stitching—form light, easy

NUCLEAR PLANT SYSTEM

By taking the plants where the workers are, Sylvania is able to tap important new sources of labor supply

Benefits to Company

1. Small-town operation enabled the company to tap new sources of labor.

2. Citizens of small communities show greater interest in their work, and hence do better work.

3. With this kind of help, fewer rejects are found among parts going into final assembly.

4. Industrial harmony is best when the plant manager knows every worker by his first name—and *vice versa*.

5. Small town workers are less inclined to absent themselves without cause.

6. Small plants offer greater incentives to maturing workers. The company has been able to develop a more effective executive personnel.

7. It proved easier, under wartime operating conditions, to transport truckloads of partially finished products from feeder plants to main plants than to move trainloads of workers from their home towns to distant plants.

work which is highly attractive to such a group. These girls are better at their jobs than city girls, but they refuse to go into industry unless they can be among friends and live at home.

Fitting Plant to Town

In 1943 the company made an exhaustive survey at Jamestown, N. Y., with a view of locating a plant there. It discovered in that town a group of second-generation Swedes who were gifted with the temperament and talents necessary to these skilled and semi-skilled trades. They were looking for steady jobs, and they proved invaluable. They formed the basis for a pool of 1800 available workers, of whom over 600 are working in the plant. It found space in a huge worsted mill built in 1870, but which had not been operated for 23 years. This problem settled, it was necessary to consult local draft boards to find out whether local policy would permit the company to retain the men once they were recruited and trained for work requiring skills. Since the men in these plants hold key positions, the attitude of local draft boards was doubly important while the war lasted. At Jamestown, of course, as in many similar cases, the company consulted the local chamber of commerce and established its attitude toward incoming industry. It also took steps to become acquainted with other plants in the area, with a view to establishing a policy which would avoid disastrous labor sniping.

In these small-town plants, managers are relatively free from bureaucratic controls. They hire, fire, set wage levels within predetermined ranges, set number of shifts and time schedules, etc. The main office decides broad policies, production quotas, sales and research objectives.

It should be made plain that Sylvania does not attempt to industrialize the towns into which it moves. On the contrary it strives to fit into the atmosphere it finds there.

Even Sylvania's main radio tube plant town, Emporium, Pa., has managed to meet its production quotas and still not give the appearance of the usual hurried, harried, and overtaxed war town. Some 370 men have gone into the armed forces, yet the company has still managed to retain 2000 workers out of a total town population of slightly less than 4000. Community activities have carried on at pretty much pre-war levels. The local jail goes empty two or three months at a time.

In another locality, the pastor of one church wrote recently: "I recently visited your new Warren plant . . . was deeply impressed with the spirit . . . every employee appeared to be most happy . . . due no doubt to the splendidly clean places to work . . . expect to use your plant as example in coming Labor Day Sermon."

In Salem, Mass., the company took over as an office an historic old sea captain's home built in 1687, the Captain Joe Emmerton house. Sole change was the installation of fluorescent lighting! The front door was kept locked. Side doors were used. No parking was allowed in front, and today this historic building looks exactly at it has always looked.

Production engineers of the com-

With the kind of help available in small towns, Sylvania has found fewer rejects among parts going into final assemblies

pany have shown a certain genius for taking abandoned textile mills, farm-produce pavilions, roller skating rinks, and garages and turning them into modern plants. Well-lighted, utilizing color schemes that make for pleasant, easy working, and a general air of good housekeeping, these plants go far toward retaining the small-town personnel that have now been trained and are valuable to the company.

Higher Real Wages

According to authoritative wage studies in metropolitan and rural areas, real wages can run from 15 to 20 percent higher for the small-town worker. Take a typical production supervisor with 5 years' service who is married, has two children, owns his own home. He was earning $3000 a year with Sylvania in 1944, whether he worked in Buffalo or Brookville. Taking National Industrial Conference Board figures for late 1944, this man spent roughly $300 a year more on the necessities of life if he lived in Buffalo.

Perhaps a fundamental reason for Sylvania's preference for small towns for their plants is that the executives, the men who founded and today run the company, are small-town men.

Many a groan went up among company executives when it came to establishing the research center for the company. It became obvious that to link the company with correspondingly large industries, the center must be placed near New York City. To quote the president, "This center should be near or preferably in the cultural and scientific center of the USA—New York City. It might be cheaper elsewhere, but that would miss the real point." It may seem odd for a company that prefers small towns to locate its research headquarters near the heart of one of New York's largest boroughs, but even here it tried to apply its rural philosophies of life. At the right of the research center is a 110-acre municipal golf course. On the left, the company bought a 6-acre estate and to the rear a 22-acre wooded plot for protection.

In the light industries, present-day communication and transportation combine to make decentralization practicable. Light trucks travel between feeder and main plants, and one truck can frequently transport the entire day's output of a small feeder.

Sylvania plants are linked by telephone and teletypewriters, and post-war plans are now under way to link them by television or facsimile recorders. The company is considering the purchase of small planes or helicopters for shuttling between the Pennsylvania hilltowns.

Music is installed in all these plants. It was learned years ago that hand and machine rhythms were complemented and smoothed by musical rhythms. Social benefits—group insurance, hospital benefits—form an integral part of all plant set-ups. Yet the management does not dump these benefits in the workers' laps with a look-how-good-we-are attitude. For 15 cents a week workers may join the Sylvania Employee Association (membership running nearly 100 percent) which is purely a recreational and benefit group. The company matches the workers' contributions. The idea is to let the worker foot part of the bill, on the old Yankee theory that then he'll appreciate what he gets.

Non-paternalism is an established policy in all plants. A group of citizens in one plant town though it would be nice if the company would build the town a community house and servicemen's canteen. The company said no —not as an outright gift. Instead, it worked up local pride and interest, got the citizens to form a committee and get the town behind them. Then the company bought an old home, got the USO to send a director for six months, and now the town has its own community house. It is now supported by the Community Chest.

All in all, Sylvania has found that its own interests coincide exactly with the psychological and economic welfare of its workers, and confidently feels that it has set up a thought-worthy blueprint for post-war industry of this type. It worked before the war. Experience has proved that it will work in a period of wartime expansion. Sylvania's management is just as confident that it will work through the months of reconversion and in the era of peacetime production when every effort must be bent in the direction of low-cost output. With that thought in mind, the company is going to keep right on giving decentralization a try.

IF YOUR COPY OF *FACTORY* IS LATE—

Be patient, please. The nation's transportation system is severely loaded. The delay may be unavoidable. Allow a few extra days before writing us. Both the publisher and Uncle Sam are doing everything they can to get your *Factory* to you on time

How Economical Operation Cut Plant Cafeteria Loss

M. A. SHERRITT, Administrative Assistant to the President, Joshua Hendy Iron Works Sunnyvale, Calif.

LOSING MONEY at the rate of $3000 a month almost caused the Joshua Hendy Iron Works to close its workers' cafeteria. Then a specialist from the Industrial Feeding Division of the U. S. Department of Agriculture was called in. His analysis of the problem involved, and his suggestions, not only showed administrative executives where the mistakes were being made, but also speeded service and cut costs so that today management can take pride in the feeding facilities it offers employees, and workers can get good nutritious food fast and inexpensively.

The peacetime foundries and machine shops of this company employed 500 people. In 1940 it looked around the corner towards war and got set for conversion. Ready when the call came from the government, the Sunnyvale plant, by 1942, was booming production on three shifts with 4000 workers, and by 1944 it employed 7500. Today's plant population is 4600.

As the plant population skyrocketed, the need for some sort of in-plant feeding facility grew rapidly acute. A few hundred employees had been able to get service at lunchrooms in the town of Sunnyvale, if they did not depend on home-packed lunches. Now, however, local facilities not only were unable to handle the crowd, but also workers were losing at least 15 minutes of their half-hour lunch period in travel. Many were unable to get served, or to get back to their jobs on time. From management's point of view there were other obvious reasons, including considerations of security, why

Twelve persons a minute can be served in the Joshua Hendy cafeteria, by a system of "pre-dishing" that always keeps a few plates ahead of the line. Speedy service is a plant cafeteria "must"

it was undesirable to check hundreds of employees in and out of the gates three times a day.

A special handicap of plant location was that San Francisco food concessionaires passed up the chance to supply workers at Sunnyvale because they had plenty of business nearer home. Even box-lunch makers turned thumbs down.

So, all in all, plain necessity joined management's interest in employee welfare to create a cafeteria inside the Hendy plant gates. At a cost of $45,000 for construction and $30,000 for equipment, the Defense Plant Corporation financed the job and in November, 1942, rented the new facility to the company. Hendy's own management assumed direction of the venture. Workers flocked to the cafeteria, and for a few days everybody congratulated everybody else.

Then the operational cost sheets came in, and with every passing week their ink got redder and redder. Why?

It had never been intended to make a profit but when feeding workers began to cost $3000 a month dead loss, and workers still were not content with the food or service, the company's good intentions started to hurt like a stubbed toe.

Some improvement was made. The monthly loss of $3000, which actually came close to shutting down the cafeteria in 1943, was whittled to $1800 during 1944. But even this improvement was a stopgap. Altruism at $1800 was not much less painful than the more expensive variety when it still failed to pay off in employee morale.

Hendy's management hired people with food service experience to supervise its on-the-job feeding venture. The trouble was, even professionals of this type were apt to fail when it came to feeding a thousand or several thousand people, within the set limits of a half-hour lunch period, and under utterly unfamiliar conditions of rationing. There were some caterers and feeding contractors in business at the time Hendy opened its cafeteria who might have been willing and able to handle the job more successfully. But the management felt that no concessionaire would take as much interest in the welfare of the workers. It was willing to take losses for their sake.

WFA to the Rescue

And lose money it did, right up to November, 1944. That was when the Industrial Feeding Division of the War Food Administration (now part of the U. S. Department of Agriculture) was called in to help unravel Hendy's tangle.

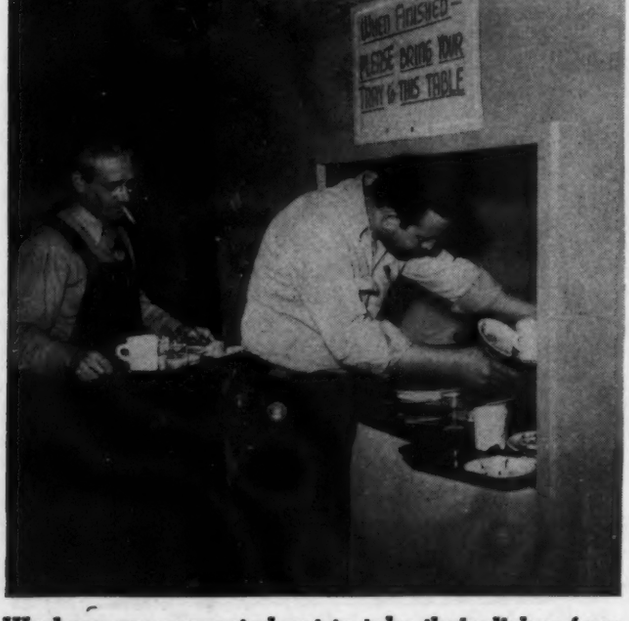
The government foresaw a need for nationwide expansion and improvement of in-plant feeding facilities even before Pearl Harbor. A full-fledged plan of action was drawn up within a few months thereafter. Then, throughout the nation, outstanding professional men and women with long experience in mass feeding, catering, and nutrition were selected to staff the new War Food Administration division.

The specialist detailed to Hendy by the WFA regional office at San Francisco was a man whose experience in every phase of peacetime mass feeding had been supplemented by specialized wartime training. He set to work immediately with plant administrative chiefs and in cooperation with the cafeteria manager. Jointly, they examined every detail of operation, from food-delivery platform to garbage-disposal truck.

The big (6000 square feet) single-roomed cafeteria seats 350 people at a time, and serves 1500 men and women during the day's three shifts. Just off the main room, which is filled with four-person tables, a canteen offers typical soda fountain service of sandwiches, a hot dish, and drinks. In addition to regular daily service the kitchen also prepares cold food for an open-air employee rally held every Saturday, for study groups in the education building, and for special dinners in the executives' dining room.

Two serving counters extend down the middle of the cafeteria in the shape of a letter U whose open end adjoins the kitchen. Three women servers and a cashier are posted along each line.

Quick service is a necessity in every war plant employing more than a hundred or two workers. When the WFA specialist counted only five people being served each minute at the Hendy counters, he had a solution immediately: "Pre-dish" the food just before lunch hour, so that carving and dishing could keep a few meals ahead of the rush demand at all times. That same line now serves 12 people a minute. Another suggestion created a



Workers are requested not to take their dishes from their trays while they eat, and each carries his own

tray to a disposal booth when he is finished. This "self-bussing" eliminated eight work positions

Attached to the cafeteria is a canteen which offers typical soda fountain service

"fast line" which makes even better time for patrons who choose the single, ready-prepared entree and cheaper meal it affords.

These first improvements made the cafeteria more popular with workers, and they boosted profits by selling more meals. But the further suggestion of "self-bussing" not only saved still more time but also a good deal more money.

Wait on Themselves

Previously a dozen women had been employed to remove utensils and empty dishes from the tables as quickly as a worker finished his meal. Even this crew found it hard to keep pace. With self-bussing in effect, each diner returns his own tray, from which dishes and silverware are never removed after serving, to one of four booths built for this purpose. The moment he leaves his place it is ready for another diner. There is rarely need even to wipe off the table. The plywood disposal booths, incidentally, are on casters and roll away easily when not in use or when floors are mopped. Most important, self-bussing plus accompanying labor-saving wrinkles reduced cafeteria labor costs by abolishing no less than eight positions.

The change from the old "bus-girl" system was not made overnight. A sudden request for extra work from employees, even though self-bussing required them to walk only a few steps to the nearest disposal booth, might have caused trouble among already dissatisfied patrons. The precaution was taken of selling the idea to workers in advance, through direct contact and publicity in the plant newspaper.

The plant foremen's committee explained the aims directly to the workers, and as soon as they saw the point they were willing and anxious to help.

Cost-cutting measures recommended by the government industrial feeding specialists have gone much farther than this. A "Daily Operation Cost Control" system has been set up to keep books on all phases of the cafeteria operation. Charts and check sheets are now made up and filled in for every day's business.

The control system centers on the maintenance of three sheets, which provide a daily check on all pertinent elements of operation.

The cost-distribution sheet shows daily expenditures for food, divided into such categories as meat and poultry, fish, bread and pastry, milk and cream, and on such items as ice, laundry, repair, and storage.

The sales distribution sheet shows the exact number of customers served by all departments, further broken down into specific periods, with an accompanying analysis of receipts for each type of service. It provides excellent spot information on relative patronage of different meals and services, including comparative week-day figures.

The managerial control sheet gives daily figures on sales, food cost, miscellaneous expenditures, balance (plus or minus), as well as cumulative sales, food costs, miscellaneous expenses, supplies, labor costs, and various percentages for the month. Thus, all operating data are immediately available as a basis for correction, adjustment, or corroboration of methods.

"Beefs" Are Welcomed

Although everyone at Hendy agrees that workers, like management, are far better satisfied with their cafeteria than they used to be, employee suggestions and "beefs" are welcomed. Grievances are "collected" by plant foremen as they are aired. They are presented at each quarterly meeting of management with the foremen's committee, where they can be analyzed and acted upon.

Evaluation of the Hendy in-feeding system in terms of heightened morale or increased production would be difficult, but consistent patronage of the company food services should indicate that the employees like it; and many of them willingly attest that the balanced, well-cooked meals which they regularly eat at the plant are of material aid in enabling them to maintain an adequate, well-rounded diet.

Meet Worker Trouble Where It Starts—and When

WHITING WILLIAMS, Consulting Editor, *Factory*

SOME YEARS AGO I got mad every time I took a room at a certain chain hotel. The room's writing table was always covered with the company president's urgent appeals that I send my suggestions, compliments, or complaints to him in New York City almost a thousand miles away! Finally I wrote him that I didn't give a hoot how anxious he was for my good will so long as, in spite of my years of patronage, his roomclerks downstairs snootily refused ever to greet or recognize me.

When his chain later went into bankruptcy, I figured it might be because he had never heard how Foch licked the Germans in 1918:

"I put up to our enemy in France," the Generalissimo reported, "a problem too new and too complex to permit his getting proper instructions *back from Berlin in time!*"

Twin Evils Ahead

It is hardly too much to say that somewhat similar disaster may be around the corner unless industry can contrive to stop its present trend towards the twin evils of over-specialization and over-centralization. Individuals have a way of going down and out. But now that so many industrial concerns have lately enjoyed huge growth, they may well fear going up and out unless they can arrange somehow to give to both their line and their local branch officers a larger measure of responsibility for meeting labor—in other—troubles there on the spot *where they start and when they start.*

If you don't consider this matter anything worth bothering about, it may be because you haven't encountered such testimonies as these:

1. "While our local manager here was negotiating a new contract with the local and International leaders, his operating vice-president was here from headquarters and secretly in contact with him from a downtown hotel. Every evening the manager would report the day's progress—and

nearly every morning have to do a lot of reversing and backtracking. Finally the agreement was ready for signature, only to have it all thrown out when the vice-president showed it to his executive committee at the home office 500 miles away. Naturally the union has never since taken this manager seriously."

2. "As local superintendent of our 5000-man plant, I'm often told to 'stall' on some issue because the home office is horse-trading with the national union for certain advantages in some plant a state or two away. That's probably unavoidable in a big outfit. But my committee men and general foremen certainly do lose their respect for me."

3. "Sure, we have a president. But the only thing we local third-line operating heads know about him is that we always have to clean up the plant a day or two before he arrives on inspection. We call ourselves his step-orphans."

4. "The president of each of the area groups that make up our concern used to be a real big shot. But not now. You see, headquarters now regularly passes over to staff experts on capital expenditures, methods, and procedures, the main responsibility for all such decisions."

5. "Now that headquarters tells us local managers so regularly, by telephone and otherwise, just what we should do and how, I sometimes almost wonder whether I myself am a part of management."

6. "How do we get along with the townspeople here? Well, you see, responsibility for this is carried by a specialist sent in from the head office. Of course, he has too many other places to cover for him to stay here long."

7. "Lots of times, after we foremen report a departmental grievance, that's the last we hear of it until, maybe weeks later, the top personnel man remembers to tell us about the final outcome. Of course, that makes the stewards thumb their noses at us."

8. "Our relations with our employer started going from good to bad when central management told us our costs of servicing here simply had to be as low as, say, St. Paul's—without any consideration for important differences in the two situations. When later our foremen were similarly high-pressured in spite of very different 'spot' conditions, they began to consider each other's cost figures dishonest. Still later, when we workers found our truthful explanations were not accepted, we had to become expert liars. Naturally morale is now badly shot."

These testimonies add up to support what everybody has long known "but lost awhile"—that the crux of most labor problems is to be found not only in some particular department or some particular locality but also in some department's or locality's *intangibles.* Hence, as treatment comes more and more to require reference up the line to some geographically or psychologically distant top, the chances of delay, of course, increase.

Wrong Treatment

Worse than that, chances also increase that the delayed treatment will be wrong. For whether the intervening gap is caused by the geography of a multi-unit outfit or merely by the psychology of a "multi-link" or "multi-step" organization chart, the difficulty of properly appreciating the problem's on-the-spot intangibles can be said to *increase with the square of the distance from them.*

Even more serious, as rapidly as decisions are more and more referred to top line or top staff, it comes to be assumed, gradually but inevitably, that all the lower and all the local responsibilities can be handled by officers of smaller and smaller ability, initiative, and caliber—with the branch manager likely to be called superintendent and the superintendent known as a general foreman.

At the same time that these subordinates grow less and less equipped and less and less willing to "stick their necks out," the need naturally increases for super-judgment, super-expertness, and super-caliber at the top. This means nothing less than a vicious spiral —one distinctly dangerous to industry's long-term future!

One big cause of this serious decline of line and local responsibility is, of course, the national union. With the help of its super-speedy system of communications, a small but successful "nibble" anywhere in the company or the industry calls forth, almost instantaneously, a demand for the same gain all along the line. In the same way, the foreman who too regularly hears of some new company policy through his union committee man, is bound to suffer a most irritating loss of face.

Fear of Legislation

Undoubtedly, however, the biggest cause is the way federal legislation and administration now make top management fearful that any slightest misstep by some foreman or other sub-official, whether out in the plant or a thousand miles away, will put the entire outfit in hot water if not in jail.

"Of course, we get a lot of headaches," so a personnel man put it lately, "from those company officials here or out in the field who don't yet know company policy, or, if they do, take a chance at something different. But all the time that we try to decentralize and make sure that local factors get proper weight, the War Labor Board, the Treasury, and half a dozen other federal outfits—to say nothing of the unions—everlastingly pour it on us to *centralize*."

The Labor Board's area panels have lately tried to improve this situation, but to date their decisions have been too often set aside by Washington to permit much betterment. Plainly enough the various federal authorities, along with many unions, particularly those of the CIO, appear to assume that their remote control is certain to benefit the workers, and that life will be both simpler and happier for everybody when all labor rules and contracts are on an industry-wide and nation-wide basis.

Nevertheless for many months now most strikes have been called, not against the employer's stubbornness, but instead against the Labor Board's delays. Already too many union members can be heard to complain that their big organization's over-all contract fails lamentably to take account of their particular needs. This complaint has shown big increase now that so many CIO heads have "gone political." Witness the recent protests of 34 local UAW leaders in Detroit against too much top-level interest in Dumbarton Oaks and too little in their members' fears of reconversion layoffs. Also now that top-level concern over union security has lately increased the number of demands which represent "leader issues" instead of "member issues."

"It used to be," averred a local organizer recently, "that whenever we local boys got in a jam we sent a hurry call for some union big shot to come out from our International office. But lately we find it so hard to give this man the proper 'feel' of our specific

FIRST AID FOR WORKER SORE SPOTS

1. Speed up intra-company "communications." Use "long distance"—also statistics—freely for quick information about the local situation's tangibles but distrust them both for getting its intangibles, its "feel."

2. Beware official insulation. Retrain (or transfer) the private secretary or assistant who considers it his or her main job to make it almost impossible for anybody to see the boss. Ditto the "yes, yes" line associate or staff specialist who fears to give unwelcome information or advice.

3. Put into ink company policies and each officer's responsibilities and authorities with respect to them—especially just how line and staff are expected to work with each other.

4. Retrain (or transfer) the specialist or other officer who neither teaches the man most directly concerned with the problem how to handle it nor enables him to get and give the right answer quickly, but, instead, persists in always handling it himself.

5. Expect and help every associate and subordinate to add to his special technical know-how the utmost of concern for justice and fairness as well as expedition. ("Want of care," so Ben Franklin put it, "does us more damage than want of knowledge.")

6. Beware the rigidity of "chartitis." Set up informal procedures whereby subordinates (especially foremen) can make an occasional or emergency end-run-around their immediate superior, making sure that the end-runner does not suffer reprisal at the hands of the "end-runnee." (I've head of a foreman who was fired because he answered his company president's question truthfully.)

7. Whenever possible, talk things over with the subordinate in his own office or town. There he's at his best because there he's closest to his problems instead of at his worst—you know where! (The farther away the subordinate is, the less dependence should be put on specific orders and instructions, and the more on his intelligence and judgment.)

8. So long as a good executive or administrator is "a man paid to make wise decisions," a company will "grow" capable officers only by furnishing to all at every level the maximum of practice and experience in decision-making. Like charity, good industrial and good public relations begin at home.

situation that he's likely to do us more harm than good."

Similarly, many small communities have observed that the representative sent in to organize the local workers made the mistake of failing to understand that these workers required a kind of "selling" campaign very different from the type that had proved successful in the big industrial centers. What is more significant, many localities regularly report that their local labor troubles occur mostly in branch rather than in home-owned and home-operated plants. As a matter of fact, no one can travel across the country without observing that almost everywhere industry enjoys the best relations both with its workers and its public in those cities where ownership and operation are local rather than national. It is hardly strange, accordingly, that there are now certain towns that refuse to invite new plants to locate unless administrative control is first made local.

Too Far Away

It is worth repeating that the current tendency to insert too much distance or time between the labor problem's "spot" start and its final solution is by no means confined to big or multi-unit business. Similar evils are suffered when the sudden growth of a small concern has been assumed to require a lot of new staff specialists or too many "steps" up to the top. So even when the "where" of some small pin prick irritation's start is under the same roof with the manager or president, the route to his attention may be too long, or encounter too much "insulation" to get attention at the proper "when." Indeed, this proper "when" is *before* it starts.

In the old days this pre-start was too often supposed to be reported by an undercover man or two—even when, as a president once put it, "We find these men so unreliable that we have to hire others to check on them."

Of the more modern methods one is the employee attitude audit. Another is to develop and utilize the foreman's awareness to his gang's current state of mind and feeling. But no method is worth much unless the top executives are accessible enough and "tellable" enough to be persuaded to quick action. Best of all is when these executives and their personnel devote themselves to training their subordinates to give the little pin prick the proper on-the-spot "first aid" before it festers into a major issue.

Several other roads toward the same objective of the nearest "where" and the earliest "when" are suggested elsewhere here. Whether the present pressures of government, unions, and other forces can be successfully resisted, is a question. But that the current trend has possibilities for serious evil has been made plain by many others besides General Foch. One reason why the Germans so generally hailed Hitler was that, before he took over, the workers in, say, Essen had to report their complaint to government's labor official first in Essen and then in Berlin. There the government's top labor man asked the government's top management man to get the facts from the Essen employer. When, in the course of time, these two in Berlin came to a decision it was communicated—as final—to the two interested parties in Essen.

Today many managers and many wage earners agree with those historians who point out that both the British and the Roman empires ran into trouble as soon as the money and the reports sent so easily into headquarters from the provinces across the Atlantic or beyond the Alps began to have a hard time securing any noticeable results back home at their starting-points. (It was doubtless as historian rather than as President that Thomas Jefferson once stated: "Were we directed by Washington when to sow and when to reap, we should soon want bread.") By the same token, our American Communists have long figured that their program is made easier as rapidly as the powers of the (once) sovereign 48 states are gradually transferred to the single District of Columbia.

The American Way

Wages must rise, and keep rising. That means real wages, representing steadily growing buying power for all who earn. Free enterprise cannot keep going, in a machine age, unless it keeps real wages rising.

But many wage-rising proposals now being advanced seem to us to ignore the fact that cash in pay envelopes is only part of real wages. The other part—and it's just as important—is production. Volume of production determines whether cash wages are real or unreal, earned or unearned.

Try to create more buying power by raising cash wages without producing more goods and services to be bought, and you only create higher prices. Those who get the wages seldom stay ahead of that game, and everybody else loses.

Try to force cash wages up and hold prices down by over-rigid government controls, and you only discourage production. Wages are a cost element in every step of production and distribution. If costs get so high that controlled prices offer no prospect of fair profit, production falters, jobs evaporate, and everbody loses.

But find a way to keep production and cash wages marching upward together, and everybody can win. Earners can have higher real wages, and all consumers can share the benefits of high production in lower prices.

We believe that way, constantly and humanely followed and extended, can lead the American people to the greatest era of sound prosperity they have ever known. We believe that schemes which seek to raise wages without increasing volume production can end only in disappointment and loss for all. *The N. Y. World-Telegram*

Work Simplification for Foremen

F. J. TITLER
Assistant Chief Industrial Engineer, Republic Steel Corporation, Cleveland

MORE THAN 2100 FOREMEN in Republic plants have been trained in work simplification principles and methods. This training has made bet ter supervisors of them and has led directly to hundreds of valuable suggestions for improvements.

Republic began in a small way some ten years ago to introduce work simplification into its manufacturing (as distinct from its steel) plants. These plants produce a great variety of finished products such as bolts and nuts, electrically welded tubing, pressed steel parts, steel windows and lockers, radio towers, airplane hangars, metal culverts, steel file cases, steel lockers, and cold drawn bars—which involve all the knowledge and techniques needed in both mass and job shop production.

Program Expanded

For several years, beginning in 1935, the work was carried on at an expanding rate by industrial engineers of the corporation. In 1939 it was decided to enlarge the scope of the work by instructing the foremen in each of the manufacturing plants. A specialist in work simplification was called in at that time to introduce it to the foremen in one plant, and during the subsequent two or three years the foremen in twenty manufacturing plants and the same number of warehouses were similarly instructed. These foremen, approximately 500 in number, are today participating in a successful follow-up program which has been carried on ever since the conclusion of the original instructions.

Sketches like this one lend the light touch to session notes supplied to members of Republic Steel's work simplification conferences, serve better than words to get key ideas across

Tried in Steel Plants

The results of this initial venture were so encouraging that Republic decided to step out into a new field and try a work simplification program in its steel plants. Perhaps this was the first time that such a program had ever been used in a steel plant. At any rate the corporation had no knowledge of any previous installation in a steel plant or even in plants affiliated with a steel company, such as the manufacturing division just mentioned. There was, in point of fact, no little skepticism regarding the value of work simplification in a heavy industry like steel, but nevertheless the decision was made to go ahead.

One steel plant was therefore elected as a pilot installation, and the course was started in the early fall of 1942. A year's trial resulted in so much enthusiasm on the part of the foremen who took the course and in such a flood of ideas for the improvement of facilities and methods that the decision to install the same program in all steel plants of the corporation

FACTORY MANAGEMENT AND MAINTENANCE • Plant Operation Library No. 89 • October, 1945
Copyright, 1945, by McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York 18, N. Y.

was not a very difficult one to make.

First, all data assembled in connection with the work in the manufacturing plants were carefully reviewed and adapted to steel plant conditions and terminology.

Course Leaders Trained

Second, it was necessary to train personnel to act as leaders. This was done by having industrial engineers from each steel plant attend a full month's intensive training course. The course was conducted by Republic's own staff, augmented to some degree by outside talent.

Then a group of foremen were selected for training in each district. This was necessary because it was impossible to train all the supervisors in a district in one year. There were simply too many of them.

The course for these first groups began in the fall of 1943 and ended in the spring of 1944, at which time a total of 800 foremen and supervisors were given certificates for satisfactory completion of the work. During the past winter a second group of 800 foremen received the same training, bringing the number trained both in the manufacturing divisions and in the steel plants up to the impressive total of 2100.

Training in work simplification, as now set up at Republic, consists of twelve sessions, each lasting approximately 1¼ hours. Meetings are held every two weeks on a strict schedule, and the number of participants in a training group is limited to fifteen.

At the first session each trainee is provided with a loose-leaf binder into which go the printed notes which he receives at each meeting and around which the discussion revolves. Trainees thus need to take no notes, can devote their entire attention to the discussion. This is important because naturally foremen are not skilled in the fine art of taking notes and are likely to get hopelessly involved in any effort to provide their own. Session notes are full and complete, run all the way from as few as six to as many as a dozen pages per session. Direct quotations in the following text are from these session notes.

Session 1

Progress and People. Largely introductory in nature, the first session emphasizes the fact that it is only natural for people to resent change and criticism, and to resist new ideas. Methods of overcoming these traits of human nature are pointed out to members of the class.

Work simplification is defined as "a common-sense method of eliminating the waste of time, energy, and material; it is concerned particularly with the waste of human energy or effort . . . by WORK we mean the expenditure of use of time, energy, or materials. By SIMPLIFICATION we mean making something easier or simpler. Therefore WORK SIMPLIFICATION means the use of time, energy, and materials in its simplest term. . . It simply involves thinking in an orderly manner about the work under consideration and then selecting the best available method that we know of at the present time."

Work simplification, it is further pointed out, is "a relatively simple means of analysis with which it is possible to eliminate most of the useless movements and to adopt more productive and useful actions. Work simplification makes it possible to produce more work with less expenditure of effort."

On the other hand, "increasing productivity does not mean the speed-up. It does not mean asking anyone to work harder or faster. In a speed-up the operator is asked to produce more *without* a corresponding change in method. We seek to develop the one best way of doing work. This results usually in shorter time but attains it by the use of improved methods and the elimination of wasted energy, not by overspeeding the worker."

Advantages to the supervisor are outlined, and the objective of work simplification is stated: *To make a better product at a lower cost at the right time with less effort.*

To accomplish the objective, supervisors must:

1. Produce the best product and give the best service of which the Republic Steel Corporation is capable.

2. Operate at the lowest cost, by the most direct method, and with the proper consideration for the interest of all groups necessary to maintain the desired result.

3. Deliver at the right time, which is essential for the company and the consumer. Under most conditions the right time is NOW.

There follows a discussion of human engineering and the need to apply the engineering approach to the problem of getting the human energy and forces to work correctly. So that the fore-

Outline of Twelve-Session Course in Work Simplification

(as developed at Republic Steel Corporation)

1. Progress and People
2. Flow Diagram and Material Chart
3. Are You Too Busy to Be Efficient?
4. Analyzing the Method for Improvement
5. " " " (continued)
6. Operator Chart
7. Analyzing the Operator Chart
8. Invest in Safety—Clean Out the Cobwebs
9. The Foreman and the Industrial Engineering Department
10. Man-and-Machine Chart
11. Making Work Easier
12. Putting the Idea to Work

man may understand what is meant by the engineering approach, it is simply defined as:

"1. Getting together all the facts possible.

"2. Analyzing the facts at hand as a basis for judgment.

"3. Making decisions based upon that judgment and the facts.

"4. Acting on those decisions and checking the follow-through.

"To say it more simply, *finding out what is wrong with something and correcting it.*"

Unfortunately, as the leader then points out, "there are three common faults with people that must be improved if we are going to do a good job in human engineering:

"1. It is human nature to resist changes.

"2. It is human nature to resist the new.

"3. It is human nature to resent criticism."

The opening session concludes with a discussion of why people resist changes, why they resist the new, why they resent criticism—and why, in spite of it all, this country has made such marvelous progress. Two reasons are given: (1) There is an occasional individual who is intensely interested in making something better through new inventions; (2) competition.

"The keener the competition, the more necessary are the services of men who can help the organization better its position. One way to better our position is to attain the objective of work simplification. In order to attain this objective, we cannot follow old habits, good or bad, but we must develop new methods and new ideas. We should not be discouraged because people think new things won't work. . .

"Progress always involves risks—you can't steal second base and keep your foot on first."

Session 2

Flow Diagram and Material Chart. Succeeding sessions plunge right into the work of the course. Examples of the elimination of time and energy are given. The right way of doing anything, it is pointed out to foremen taking the course, is an art.

"Unfortunately we do not usually do things the right way unless we are compelled to do so. We discover for ourselves exactly how a certain thing should be done when it is a matter of life and death. The surgeon, for instance, has applied motion economy for years. Why? Because it was a matter of life and death. The horse-drawn fire apparatus is another example. Some of the finest examples of motion economy were used with this equipment, such as pre-positioned harness, sliding poles, and a place for everything and everything in its place. Why? Because again it was a matter of life and death. In business, competition often forces us to accomplish the same results. . .

"No definite or permanent advance is ever made in any kind of work, whether with materials, men, or paper forms, until use is made of measurement. This is especially true of advancement of the human factor, which varies so much that, unless we use measurement and abide by the results, there is no possibility of repeating the process accurately and efficiently at will, or of predicting and controlling the future conditions which assure advancement.

"The measurement tools we will

Approximately 2100 foremen have been trained to date in Republic's work simplification courses. Beginning in a small way in 1935, the program was extended in 1939 to include 500 foremen in manufacturing plants and warehouses. It worked so well there that it was decided in 1942 to try it in the steel plants, where two subsequent series of conferences have schooled an additional 1600

WORK SIMPLIFICATION CHART

CHART TYPE 8" Mill Rounds
OPERATION Straighten, Pickle & Oil
SUBJECT CHARTED Bar of Steel
CHARTED BY W. E. Darnall

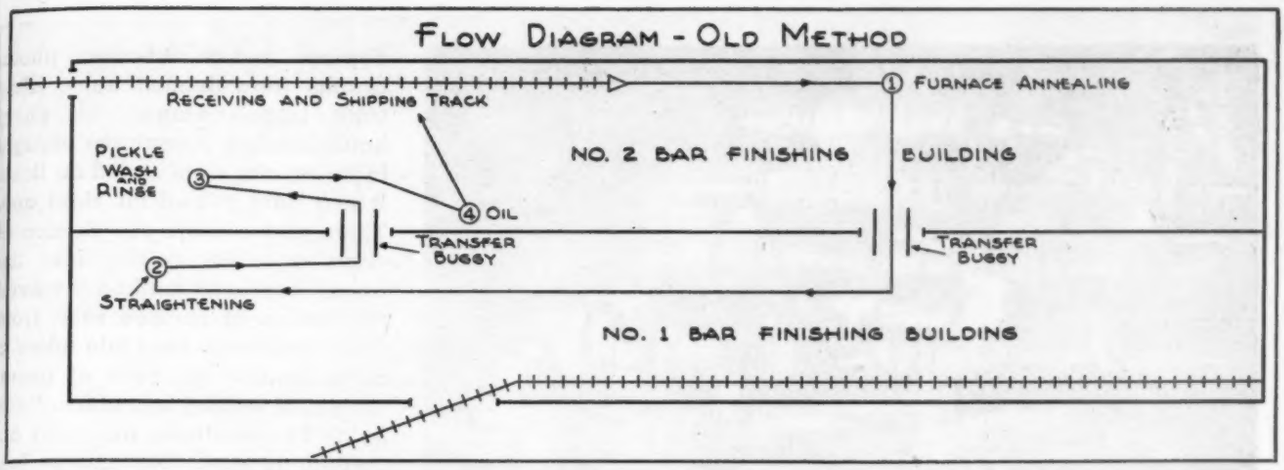
DATE April 10 194
PLANT Buffalo
DEPT. Bar Finishing
CHART No. 1 SHEET No. 1 OF 1

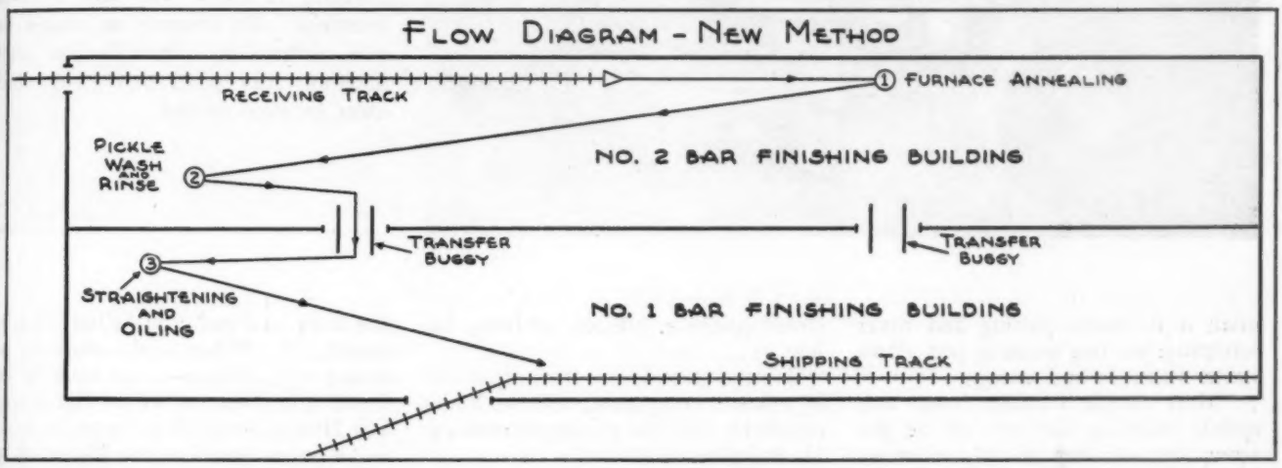
SUMMARY			
METHOD	PRES.	PROP.	SAVING
Operations	22	14	8
Transportations	10	6	4
Storages	5	4	1
Inspections	1	1	0
Total Elements	38	25	13
Distance Traveled	890'	670'	220'

CAN I ELIMINATE? **CAN I COMBINE?** **CAN I CHANGE SEQUENCE?** **CAN I SIMPLIFY?**

DESCRIPTION OF PRESENT METHOD	Operation ○	Inspection □	Transp. ○	Storage △	Distance	Distance	Operation ○	Inspection □	Transp. ○	Storage △	DESCRIPTION OF PROPOSED METHOD	
1 Await crane at furnace annealing	•		•				•		•		Await crane at furnace annealing	1
2 Hooked											Hooked	2
3 To transfer car -- (crane)					60'	350'					To pickle -- (crane)	3
4 Unhooked											Tie wires removed	4
5 To No. 1 building -- (transfer car)					40'		•				Pickled, washed, rinsed, dried	5
6 Hooked											Wired with tie wires	6
7 To straightening storage -- (crane)					350'	80'					To transfer car -- (crane)	7
8 Unhooked											Unhooked	8
9 Await straightening machine & crane						40'					To No. 1 building (transfer car)	9
10 Hooked											Hooked	10
11 To straightening machine -- (crane)					40'	40'					To straightening storage -- (crane)	11
12 Unhooked											Unhooked	12
13 Tie wires removed											Await straightening machine and crane	13
14 Straightened, inspected, cradled	•										Hooked	14
15 Wired with tie wires						40'					To straightening machine -- (crane)	15
16 Awaiting crane											Unhooked	16
17 Hooked											Tie wires removed	17
18 To transfer car -- (crane)					80'		•				Straightened, oiled, insp., cradled	18
19 Unhooked											Wired with tie wires	19
20 To No. 2 building -- (transfer car)					40'						Awaiting crane	20
21 Hooked											Hooked	21
22 To pickle -- (crane)					80'	120'					To storage for shipment (crane)	22
23 Tie wires removed											Unhooked	23
24 Pickled, washed, rinsed, dried	•										Awaiting shipment	24
25 Wired for shipment												25
26 To storage ahead of oiling -- (crane)					100'							26
27 Unhooked												27
28 Awaiting oiling												28
29 Hooked												29
30 To oil tank					40'							30
31 Dipped in oil tank	•											31
32 Unhooked on drying braces												32
33 Dried												33
34 Hooked												34
35 To storage					60'							35
36 Unhooked												36
37 Awaiting shipment												37
TOTAL →	22	1	10	5	890'	670'	14	1	6	4	← TOTAL	

TOTAL PRODUCT
ADDED VALUE
NO VALUE





At second session of conference, supervisors are taught how to make simple flow diagrams (above) and material charts (on facing page). In example shown here, operations were cut from 22 to 14, transportations from 10 to 6, and total distance traveled from 890 to 670 feet

use in work simplification are: (1) Flow diagrams, (2) material chart, (3) operator chart, (4) timing device, (5) man-and-machine chart."

The first two of these five tools are described at this second meeting. Included in the session notes are flow diagrams, for example, of the old and new methods of cutting hardwood blocking, in which distance traveled has been cut out from 484 to 33 feet. Flow diagrams show up all backtracking, changes in direction of flow, work stations, and storages—and thus provide the foundation for the material charts which follow.

Typical flow diagrams and material chart taken from the session notes are illustrated above and on the facing page, and cover the strengthening, pickling, and oiling of 8-in. bars of steel.

The material chart is a detailed record that indicates the sequence of any process. It is thus a device for visualizing a process in order to improve it. The chart shows clearly the three divisions of any job: (1) *Make-ready*, which embodies the elemental operations performed in order to get ready to do the job; (2) *do*, involving the element or elements which actually accomplish the objective of the subject operation being analyzed; (3) *put-away*, pertaining to the elements that follow the actual *do* and performed after the objective has been accomplished.

Four symbols are used in charting—a circle for an *operation*, a square for an *inspection*, a smaller circle for a *transportation*, and a triangle for a *storage*.

Republic uses a simplified form for all chart work. Noteworthy is the column headed by the four symbols just mentioned, with dots at every line of the chart to represent those symbols. It is thus unnecessary for the man who makes the chart to draw any symbols. All he has to do is connect the proper dots by straight lines. The movement of material is thus graphically represented, when the chart is completed, by a series of straight lines between dots.

Also noteworthy is the vertical division of the four rows of dots into two sections, with the second section (*transportations* and *storages*) labeled "no value added to product."

The present method is analyzed on the left half of the chart; the proposed method is detailed on the right. A summary block is provided at the top to show totals. There is space on the back for flow diagrams.

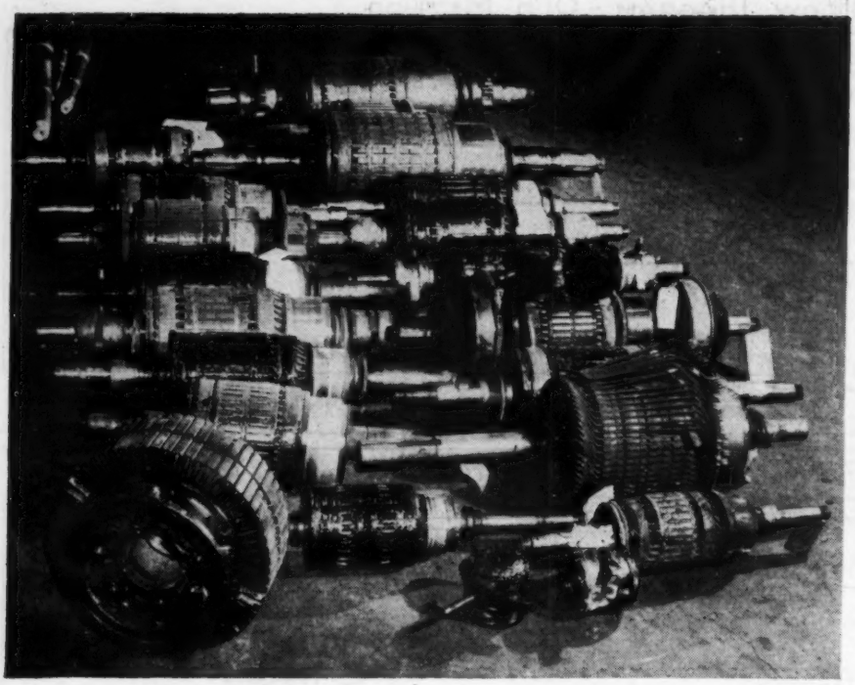
Foremen are instructed to draw a simple flow diagram and construct a material chart covering a product, part, or material with which they are especially familiar within the plant or which they want to discuss for improvement. This constitutes their "homework" for the fourth session scheduled two weeks hence.

Session 3

Are you too busy to be efficient? The leader, early in this third meeting, suggests that foremen ask:

Am I really managing my job, or is my job managing me?

Orderliness, it is pointed out, reflects good management. The first step in obtaining orderliness is the proper utilization of time. Time, the leader emphasizes, can be definitely meas-



Typical before-and-after photographs from session notes illustrate improvement in shop housekeeping. Armatures brought in for repairs were stored on floor. It was hard to find the right one. There was always the chance of chips and dirt getting into the units. Improved method involved fabrication of storage rack from ⅛-in. steel plate bent into tubes to accommodate all sizes of armatures and welded into place. Rack holds 53 armatures, arranged according to size. No time is lost hunting. No chance of chips or dirt getting in. Installation cost $366.42, has paid out over and over in time saved

ured; it is always passing and never returning; we can waste it just as we waste materials and energy.

"Most people confuse hurry and speed, believing the two to be the same. As a matter of fact, when we hurry, our work output is reduced unless the hurry is carried on only for a short interval of time. Try to eliminate hurry from your program of life. Take things easy, but concentrate on the task at hand. Soon you will be able to accomplish much more with comparatively little additional effort.

"To do this, you must understand the difference between work done at high speed and work done in a hurry. The first will give perfect work, because the speed is obtained by eliminating all unnecessary activity. Work done in a hurry gives bad work because it is a speed-up of all operations, necessary and unnecessary. This is a difference that many people in industry do not appreciate and one that should be brought out to every worker in the organization."

Time is gained, trainees are told, by proper planning. "Ask yourself: (1) Am I doing work others can do? (2) Am I doing work others should do? (3) Am I doing too much walking? (4) Are there any operations I do that are unnecessary? (5) How much of my work is being planned? (6) Am I really managing my job or is my job managing me?"

Time is gained, the leader continues, by good instructions. He then outlines (1) how to get ready to instruct a new worker or an inexperienced worker on a new job; (2) how to instruct (prepare, present, perform, follow up).

Time is gained, it is then explained, by efficient equipment, and the leader concludes with the parting injunction: *Do today's work today!*

Session 4

Analyzing the method for improvement. By this time each of the foremen has developed a material chart covering the present method followed in some operation under his supervision. The objective now is to study the chart for possible corrective measures.

"Probably the best approach to use in analyzing any job for improvement is to use the analytical approach and the questioning attitude. . .Most of us are acquainted with someone whom we think of as having an analytical type of mind. . . What does this person do that we don't do? If we observe closely, we find that (a) he asks numerous questions; (b) he does not take anything for granted; (c) he questions the minutest detail; (d) he is continually thinking constructively; (e) he puts the facts together in the proper relationship; (f) he maintains the questioning attitude."

The four marks of an analytical mind, the instructor explains, are (1) the simplicity to wonder, (2) the ability to question, (3) the power to generalize, (4) the capacity to apply. To say it more simply, the four things the foreman must do to get results are: *Observe, think, decide, act.*

First he must ask: (1) *Why* should the work be done? (2) *What* is to be done? (3) *When* is the work to be done? (4) *Where* is the work to be done? (5) *Who* is to do the work? (6) *How* is the work to be performed?

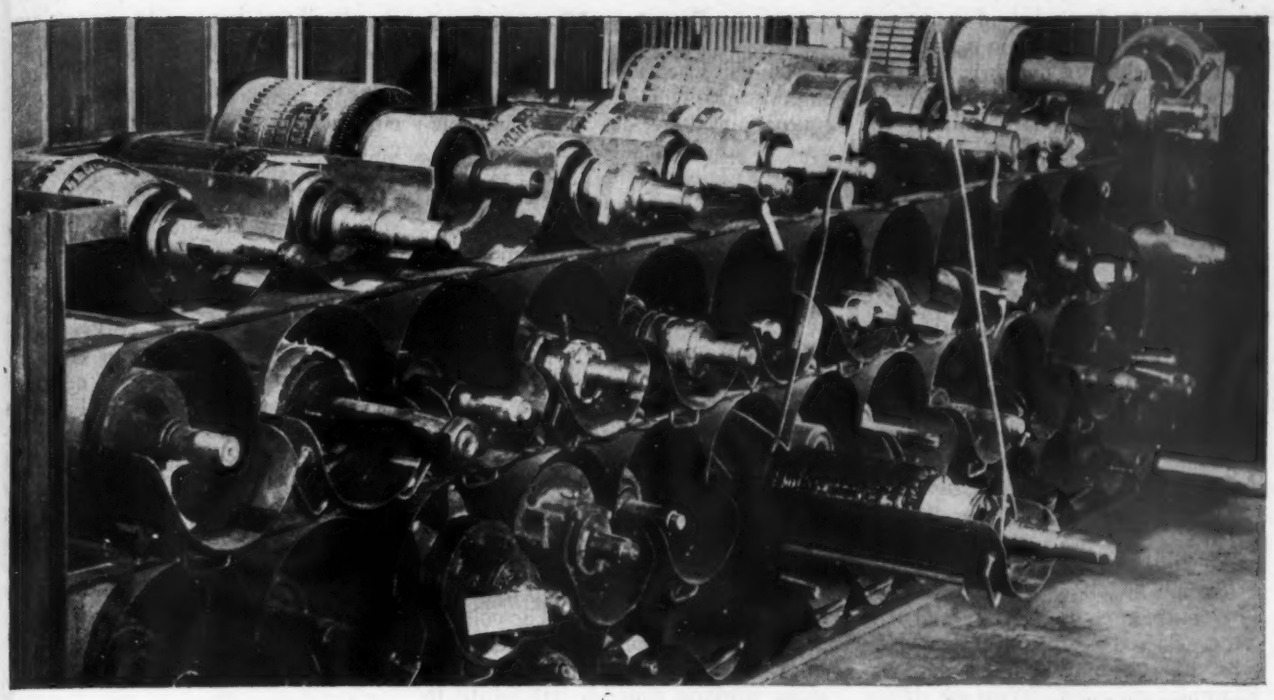
These six questions are discussed in detail, and then an actual operation, *casting and fabricating a coke oven door frame,* is studied. A motion picture film is used to illustrate the old and the new methods.

Assignment for the next session is to apply the six questions to each of the *do* elements on the material chart that has been prepared, then to each of the *make-ready* and *put-away* elements. If the trainee has a proposed improvement, he is then to chart the proposed method on the right-hand side of the form. He is also instructed to make a sketch or flow diagram to help others understand the proposal.

Session 5

Analyzing the method for improvement (continued). To extend the application of the questioning method and to aid in further analysis of the material chart, four factors are considered which evolve from the six "prompters" discussed at the previous meeting:

Factor	*Prompter*
1. Can we eliminate?	Why? / What?
2. Can we combine?	When?
3. Can we change the sequence?	Where? / Who?
4. Can we simplify?	How?



Each of the foregoing factors is discussed in detail. Can we eliminate? An actual example of the elimination of work is provided in the session notes and illustrated by showing a film. If it is determined that elimination is not possible, the next step toward simplification is the development of a combination of operations or elements. Again an example is given in the notes. Again a film is shown. If it is not feasible to combine, can the sequence be changed? Flow diagrams of an improvement in the bar finishing department in one of the Republic districts is used to illustrate a change in sequence. Finally, can we simplify? Once more a film is used, this time showing the operation of loading castings into a tumbling machine.

Work assignment: Question each element in present and proposed charts. Change proposed method to incorporate improvements.

Session 6

Operator chart. "One of the principal objectives of this program is to make work easier and to eliminate, as far as possible, much of the drudgery connected with all tasks. We are therefore vitally interested in any change that affects the employee who plays an integral part in processing the material charted. The best means of recording and later analyzing the duties of an operator is through the use of the operator chart. This, the third tool of work simplification, makes it possible to find the waste efforts in the movements of an operator in much the same manner as the material chart brought to light the waste elements of the procedure studied.

"A foreman in a plant once pointed out to a visitor that all the people in his department were busy. What he stated was true, but unfortunately he did not distinguish between all work and useful work. The man working just in front of the visitor was spending one-third of his time walking to the far end of his bench and picking up the material he was using from a stockpile on the floor. Excessive walking and bending is work—hard work—but certainly adds no value to the product. There is no waste of any type that equals the waste from needless, ill-directed, and ineffective movements and the resulting unnecessary fatigue. Because of this, there is no industrial opportunity which offers a greater return than the transformation of ill-directed and ineffective movements into efficient activity.

"To make an operator chart we use the same symbols and chart form that were used on the material chart. The only difference is that here we focus our attention on the operator and record his movements instead of the movements of material. When you have decided on the subject—the individual—don't change. Each step and detail recorded must apply to the activities of that particular person."

As in the material chart, the three divisions of work—*make-ready*, *do*, and *put-away*—are shown in the operator chart. Flow diagrams also are used to illustrate both the present and the proposed methods.

Discussion of an actual example, *loading pickling racks*, follows. A film is shown. Applications are reviewed. Sample operator charts are included in the session notes. For the next meeting the trainee is asked (1) to prepare a chart of an operator connected with the material chart he has already made, or (2) to construct an operator chart of an activity that has been troublesome, such as a bottleneck operation or a hazardous job.

Session 7

Analyzing the operator chart. The leader points out at the opening of this meeting that analysis of an operator chart follows the same pattern applied to analyzing a material chart problem. This approach requires an open and unbiased mind to locate the true trouble and to find ways to correct the fault.

Trainees are instructed to:

1. *Observe*—record the present method of a job on a chart.

2. *Think*—question by using the six prompters.

3. *Decide*—select and record a new method.

4. *Act*—install the new method.

Members of the class are then shown how the questioning attitude is applied to a materials handling problem. Detailed discussion of materials handling by operators follows. It is pointed out that *the part that is least handled is best handled.* Every effort should therefore be made to reduce materials

handling. A check list of questions that should be answered in connection with the analysis of charts is included in the session notes—also additional operator charts, one charting the activities of a tractor operator in weighing and stocking wire coils, the other recording the activities in the coil inspection of buckle wire.

Session 8

Invest in safety—clean out the cobwebs. At this meeting it is emphasized that "work simplification seeks to find the best way of doing a job—and, surprising as it may seem, the best way is usually the right way. The best definition of safety is—*the right way of doing a job.* The right way of doing a job is the *safe* way, and the safe way is the *right* way."

Discussion follows of safety through (1) elimination of traveling and handling, (2) reduction in number of details, (3) cleanliness and orderliness. Examples are given. Films are shown. And, like all other examples and films used in the program, they show operations familiar to the foremen.

Session 9

The foreman and the industrial engineering department. "Years ago," it is pointed out, "the foreman not only directed the activities in the department, but he performed a great many of them himself. When he needed more men he went to the gate and hired them; he dealt directly with customers, quoted prices, and estimated delivery dates; he ordered the material and started the work; he inspected the finished product and shipped it.

"Today many of these services are performed by others. Business has become too complex for one individual to master the improved technique now required for satisfactory performance of these functions. It has become necessary for individuals trained in each line of endeavor to perform these functions for the foremen."

The leader then discusses the services rendered by the order, inspection, shipping, industrial relations, accounting, mechanical engineering, service and auxiliary, and industrial engineering departments, and shows how each affects the foreman as manager of his department.

Major part of the discussion is built around the industrial engineering department, with emphasis on incentive systems, advantages of an incentive system, how to have a good system, presenting the incentive rate, how to maintain a good system, the foreman's part in a "check study."

Session 10

Man-and-machine chart. "With operations involving men, machines, or equipment there are three possible ways to lose time: (1) Idle operator time; (2) idle machine time; (3) combination of idle operator and idle machine time. The first step in undertaking the elimination of idle time is to determine when the idle period occurs, its duration, and what its relation is to the part of the cycle during which the operator is occupied. This may be shown clearly by the man-and-machine chart."

For this chart Republic uses a flexible form divided into four principal sections with a time scale located between each pair of sections. On this chart it is possible to record the activities of one man and one machine, one man and two machines, two men and one machine, and so on. The column adjacent to the time scale is filled in in red to show idle time, in black to show working time, is left white to indicate set-up time.

Members of the class are shown how to construct these charts; sample charts are provided in the session notes. Study the men and machines simultaneously, foremen are told. If there are too many for one observer to watch, secure a helper and divide the job with him. Set up a chart with a sufficient number of columns in order that each man and machine can be charted individually. Select a time scale which will permit a chart of reasonable size, and at the same time make it possible to put in all the necessary detail. Emphasize the idle time that appears on the chart through the use of red. Exhaust every opportunity for improving the use of machinery and equipment now on hand before considering the purchase of new.

Session 11

Making the work easier. In this session the foremen are instructed in the principles of motion economy. If a job is set up properly, it is pointed out, the operator produces a reasonably large quantity of good work without undue physical or mental fatigue.

The back, for instance, should be free from all strains and movements. Hands and arms should be used in the most effective manner. Hands should be free for productive work. Work should be done with a natural rhythm. Nervous tension should be eliminated from every job.

Working areas are discussed. So are the five general classes of motions —those involving (1) fingers, (2) hand about wrist joint, (3) lower arm about elbow joint, (4) upper arm about shoulder joint, (5) shoulder about back and hip joints. The shortest and simplest motions, the leader emphasizes, are the fastest, most accurate, and least fatiguing. Motions should always be confined to the lowest classification with which it is possible to perform the work properly.

Session 12

Putting the idea to work. "With numerous improvements in each department, it now becomes necessary to take a look at the material flow in the entire layout and to consider the efficient arrangement of equipment . . . One of the first progressive aids to the study of departmental layout is the layout diagram."

The more important rules to follow in laying out the department are discussed. Advantages of good layout are summed up:

1. Shortening of travel time of product in process
2. Saving of floor space
3. Less walking by the machine operator
4. Reduced materials handling time and effort
5. Increased production by man and machine
6. Lowered production costs
7. Smaller inventory of goods in manufacture
8. Better cost control

Sidelights

• Motion pictures have been found extremely useful. Familiar scenes from Republic plants are used. Movies give everybody a chance to offer ideas for improvements. Also, they may be slowed down or re-run for intensive study. They become permanent records and can be used in one Republic plant after another.

• Group meetings are only part of the program. Contacts between leader and foreman are fully as important and in many cases more productive of creative work.

• The leader helps the foremen determine the monetary savings involved in an idea for improvement. The two working together then assemble the facts into a presentable form to be transmitted to higher executives.

• The leader is invaluable also in developing and pushing along good ideas which might otherwise be stalled somewhere along the route.

How Constant Education Keeps Nine Plants Safe

A TECHNIQUE FOR PEACETIME PRODUCTION

"KEEP SAFETY FLAG FLYING—An Accident Will Bring it Down." Lettered on a flagpole at the entrance of every Pullman-Standard Car Manufacturing Company plant, these words epitomize the spirit of safety that permeates every phase of this company's operations.

When the shipbuilding division of Pullman-Standard won the highest award in the Victory Shipbuilding Contest for 1943—the initial Admiral Land Trophy—for being the safest shipyard in the United States, the event was startling, because Pullman-Standard had then been in the shipbuilding business only 16 months, yet its accident rate was seven time better than the average of the 267 competing yards—4.2 against 31.2.

Pullman-Standard's safety records date back to 1923. The 1944 frequency rate of 4.10 and severity rate of 0.89 are evidence of the company's constant vigilance against accidents, in contrast with the 1923 rates of 25.60 and 2.94. (Frequency rate is based upon number of accidents per 1,000,000 man hours worked. Severity rate is based upon number of days lost per 1000 man-hours worked.)

Pullman-Standard's safety program is divided into two coordinated parts: (1) Maintaining a safe plant in which to work; (2) educating its employees to make them safe workers.

This program is conducted by a Bureau of Safety and Compensation, located in Chicago, operating under the jurisdiction of the director of safety, who is responsible to the president and vice-president.

The company operates nine plants, located in Chicago; Hammond and Michigan City, Ind.; Bessemer, Ala.; Butler, Pa.; and Worcester, Mass. Each plant has its own safety department with a safety supervisor and a staff of safety inspectors. Plant safety supervisors are responsible to the safety director.

In addition to this official set-up, workers have their own safety committees—as many as 20 in the larger plants—to study safety thinking and how to promote a sense of safety among their fellow-workers. These committees, which meet monthly, consist of supervisor's groups, departmental leaders' groups, and men and women worker groups.

The supervisors' committees are permanent. Their meetings take the form of conferences with members of the bureau of safety on different phases of safety prepared by the bureau such as reasons for safety, the safety record and what it means, after an accident, safety instructions, providing a safe place to work, unsafe practices and conditions. These discussions are loaded with everyday problems and daily recurring incidents in every supervisor's experience. Copies of the minutes of each meeting are forwarded to plant management and to the safety department.

The leaders' and workers' committees, which are appointed by the foremen, change personnel every four months. These groups elect their own chairmen, but at each meeting a member of the safety department sits in as adviser. The duties of these committees include (1) meeting monthly to discuss the entire accident prevention program, review accidents and their causes, review statistics and departmental standings; (2) presenting recommendations for improvement of plant conditions observed; (2) assist-

Safety committees composed of workers make periodic inspection trips. Duties of these committees include reporting unsafe conditions, acquainting fellow-workers with safety rules, seeing that rules are kept. Left, badge worn by all safety committeemen

ing where possible in enforcement of safety rules and regulations, maintenance of safeguards, safety devices, and equipment; (4) acquainting fellow-workers with the accident prevention program and securing their cooperation; (5) making an occasional inspection in a body, reporting any unsafe conditions and practices. Among the unsafe practices emphasized are violations of rules and regulations, particularly the rule of common sense, not following instructions, taking chances, using poor judgment, using unsuited or defective equipment, using makeshift tools or equipment. Copies of the minutes of these meetings also go to plant management and the safety department.

Thus each four months hundreds of workers have firsthand experience with the mechanics and practices of a well-rounded safety program. At the time of appointment each committee member receives a letter of congratulation from the general superintendent and, when retiring, a letter of appreciation from the safety director.

No matter where they work, employees are constantly reminded of the necessity for using every precaution. Men who might fall into water must wear the life saving vests provided for their protection

Safety plus good looks characterize women's uniforms. Note safety cap, shoes, goggles. Short sleeves and no jewelry are mandatory

Each plant provides complete medical facilities—surgeons, registered nurses, emergency beds, and a completely equipped dispensary. The Chicago main plant supplies the additional services of an oculist and a dentist.

Physical Examinations

All workers are given a thorough physical examination at the time they are employed so that no man who has a disability will be put into a job where that disability will either subject him to hazards which his physical condition cannot stand, or where he will in any way subject his fellow-worker to any danger of accident.

Employees over 50 years of age are given annual examinations. Certain other classes of employees—crane operators handling heavy loads over the heads of workmen, for instance—are given more frequent examinations. Men who are exposed to paint and to other hazards are given periodic examinations at what experience has indicated are proper frequencies. Employees requiring prescription lens goggles are given a proper ocular examination. The goggles are furnished without cost.

The safety department encourages employees to take first aid training. As a result several thousand leaders and workers are qualified to render first aid. This training has proved advantageous in many off-the-job accidents.

Every employee is warned that he must report promptly every injury, no matter how slight it is, in order to avoid the danger of infection. Neglect to observe this rule is reported by letter to the foreman, who must get in touch with the injured employee, learn from him the cause for delaying treatment, and then by letter advise the superintendent and safety department. As a result infections are negligible.

At the end of each month the safety department furnishes each supervisor

a summary of all lost-time injuries, showing the type of injury, where it happened, the result, the probable lost time, and how repetition can be avoided.

When a lost-time accident occurs, a special investigating committee, consisting of an assistant superintendent, a general foreman, a foreman, the plant safety supervisor, and a safety inspector, makes a complete investigation. From its deductions plans are developed to prevent a recurrence. The committee renders a written report of the entire situation to the safety bureau, which sends copies to the president, vice-president, works manager, and general superintendent. In certain cases accidents that cause no injury are treated in this same manner.

Always on the Watch

Yards and buildings are zoned. Each zone is in charge of day and night safety inspectors who circulate continuously through the plants, on the alert for accidents or unsafe conditions or infringements of safe practices. They make their recommendations for safety improvement to foremen and leaders—verbally in minor cases and in a written report in important cases. If his advice is not heeded, the inspector reports the neglect to a higher supervisor. The inspection of cranes, staging, ventilation, and electrical apparatus is made by qualified maintenance employees with the safety inspector collaborating.

Every new employee, the day he is employed, spends an hour in a safety indoctrination class, where he receives full instruction in company policy, plant rules, and safety practices. Before he reaches this class he has been furnished a pair of standard impact-resisting goggles, a prescription for special refractory safety lens goggles if necessary (in which event he is furnished a pair of safety glass cover-alls for use over his own glasses until the special goggles are received), a general plant safety rule book, and special safety rules and regulations applying to the individual craft for which he has been hired—welding, wood machine operations, foundry, for example.

The instructor discusses the three kinds of industrial accidents: Worker injured, equipment damaged, material spoiled. He stresses the necessity for always wearing goggles in the plant wherever there is eye risk, stating that 40 percent of all injuries would be to the eyes if left unprotected by goggles. And he exhibits shattered goggles which have saved the eyes of persons wearing them. In 14 years only three persons have lost eyes in Pullman-Standard plants. One was an electrician who removed his goggles for "just an instant."

SAFETYGRAM
PULLMAN-STANDARD CAR MFG. CO.
BUREAU OF SAFETY
SAFETY RULES
IT ISN'T HOW OFTEN YOU READ THEM— IT'S HOW WELL YOU KNOW AND APPLY THEM

Bulletin boards at all Pullman-Standard plants carry ever-changing safety messages. The "safetygram" above is an example

He also tells the new worker that most injuries are unnecessary, that very few accidents are caused by machines, but mostly by human failure to be careful. He cautions against behavior which results in accidents—horseplay, running, poor housekeeping, careless handling of materials, scattering of tools and material on the floor for someone to trip over, leaving oil and grease an the floor where someone may slip and fall.

He exhibits safety shoes with a steel cap in the toe and shows how they save the wearer's feet from injury.

He explains the compensation laws of the state and the amount of money an employee receives when injured, showing the financial loss incurred. He makes it very plain that an injured employee loses in all ways and enumerates these losses.

Meantime the safety department, by letter, informs each foreman of new employees assigned to his department, listing names and check numbers, and requesting that he give the workers his personal attention on safety instruction. Emphasis is placed upon the four essential steps that should be followed in instructing a new employee: (1) Tell him; (2) show him; (3) test him, and be sure he understands; (4) check and supervise him to be sure that he follows instructions during the first five minutes he is on the job, because it is during the initial period of employment that employees are most receptive to company policy, suggestions, and instructions. The letter reminds the foreman that 65 percent or more

of the company's injuries would be prevented if the personnel, especially the new man, were properly trained, instructed, and disciplined.

Throughout there is evidence that Pullman-Standard plants are safe places to work in, and of the beneficial results obtained by the safety educational program.

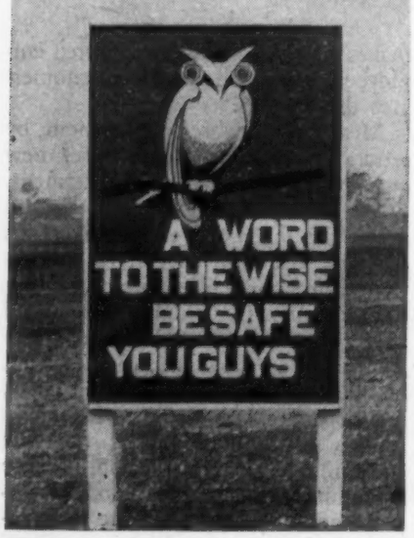
All machinery is well guarded and equipment is made safe. When the purchasing department buys machinery, it specifies the guarding necessary for the approval of the safety department. If a machine is not as well guarded as the safety engineers consider necessary, other guards are installed before it is put into operation. Thus machinery accidents at Pullman-Standard rate the lowest of all accidents, being less than 2 percent.

Safety Rules

Housekeeping is a factor that the safety department continuously stresses as all-important. Floors and aisles are kept free of material. All workers wear goggles. Men and women who operate machines wear short-sleeved shirts. Stretchers are conveniently located and goggle cleaning stations are placed strategically throughout the plants.

Inside the buildings safety bulletin boards display ornamental safety records, "safetygrams," safety posters, or home-made posters in color. Special departmental safety rules in placard form are posted in departments and locations where they apply.

At the main employee entrance of every Pullman-Standard plant is a large bulletin board bearing the safety record of every department in the plant. Illuminated moving message machines displaying messages and slogans are placed where easily seen. Safety slogans are painted in large letters on the outside of the buildings. Another safety display is a placard exhibited by every department showing the length of time since an accident occurred there.



Posters outside the plants remind workers that the company expects them to work safely

The educational program is a perpetual activity. Every issue of the company's monthly magazine and the plants' bimonthly newspapers carry safety editorials and news stories, together with material furnished by the National Safety Council. Sound slide safety pictures are shown at safety committee meetings, at mealtime, and when other opportunities present. Representative supervisors and employees attend safety sessions and banquets. Supervisors periodically receive safety letters from the superintendent, the works manager, the vice-president, and the president on safety at home, on the street, and on the job. Each Christmas every employee receives a letter from the president containing a safety greeting and a National Safety Council calendar.

Employees are encouraged to present safety ideas through the company's suggestion system. Each suggestion is acknowledged by a letter from the general superintendent's office. Many thousands of safety suggestions have been adopted through the years. Cash awards and merchandise prizes, such as safety shoes, leather billfolds, leather pocket secretaries, are given for adopted suggestions.

One of the most important safety devices is an arc welding safety panel recently developed at the Michigan City Car plant which is now in use in all Pullman-Standard shops.

Thus Pullman-Standard, by constantly keeping alive the spirit of safety, is working ever toward the ultimate goal of an irreducible minimum of accidents. It is the safety spirit back of this safety program—a spirit which has created and established a sustained teamwork throughout the whole company organization—which is responsible for its achievements.

SPECIAL SAFETY RULES

SPECIAL SAFETY RULES
FOR TRUCK AND TRACTOR OPERATIONS

SPECIAL SAFETY RULES
FOR UPHOLSTERY OPERATIONS

1. READ AND COMPLY WITH THE GENERAL SHOP SAFETY RULES.
2. Caps should be worn by all female employees at hair untwisting machines.
3. Keep guards in place over hooks on hair untwisting machines.
4. Replace guards on sewing machines when taken off to adjust or change attachments.
5. Thimbles must be kept in good condition to prevent possibility of needle going through and puncturing finger.
6. Keep empty spools and strings off floor to prevent anyone tripping on same.
7. Never place hands close to needles of hair picking machines. No gloves are to be worn when operating this machine.

In addition to the general safety rules, each craft has special rules, displayed on bulletin boards in the departments affected. Workers in these departments receive leaflets containing the same regulations

New Jobs for War Workers

WHEN THE GAS MASK DIVISION of Johnson & Johnson, Chicago, opened on the Friday after the peace celebration, the telephone switchboard was flooded with calls from personnel directors and other executives of peacetime plants, asking for workers. Indications pointed to the placement of all gas mask division employees within ten days or two weeks.

At a mass meeting on the following Wednesday, workers were told that all contracts had been canceled, and that they were all jobless. But they sang and shouted, and were anything but gloomy.

The reason for these two manifestations was a plan devised months ago, which pointed the full facilities of the plant, immediately upon termination, to the task of finding new jobs for all.

The plan was called "the cream of the crop," and derived its name from the company's endorsement of its workers as the cream of the crop of displaced war workers looking for new

Prepared Ahead of Time

As long ago as December, 1944, a descriptive 4-page broadside was prepared and stored away for use when the end of the war would bring an end to war jobs. With the exception of an insert, printed quickly a few days before the termination of the company's war contracts, which brought the information it contained up to date, the broadside was distributed as originally printed.

It was mailed to 1400 Chicago employers of peacetime labor. Employers of 24 or more people were selected. It was mailed also to 600 officers and directors of Chicago national banks, and one copy was given to each employee.

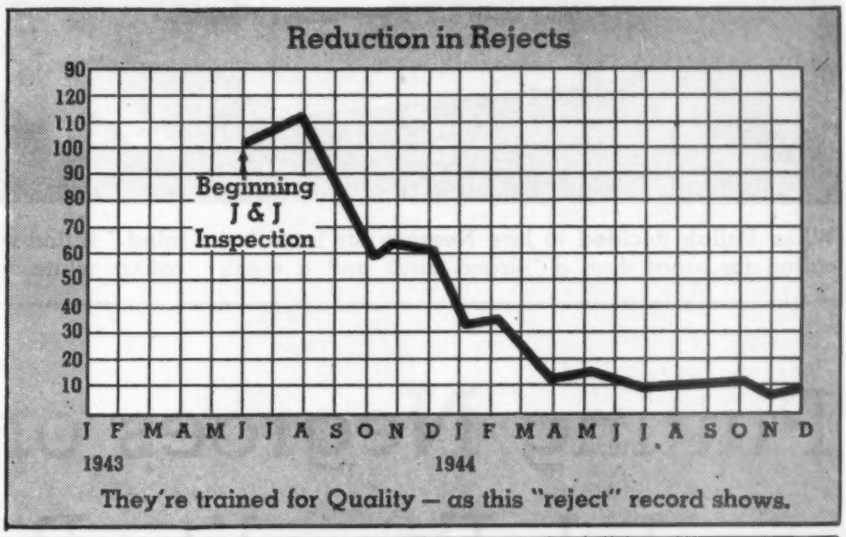
The broadside, in general terms, describes the high quality of the gas mask division personnel, and is a strong recommendation of their capabilities. Specifically, in chart form, it dramatizes their good wartime record in low turnover, reduced absenteeism, reduction in rejects, accidents, and so forth. Job classifications within the plant are listed as an illustration of the variety of types of workers available.

The broadside and insert were only part of the plan. Supporting it a 1000-line display newspaper advertisement was placed in all Chicago newspapers. It was headed, "A Vital Message to All Chicago Employers and Company Executives Concerned With Making Profits."

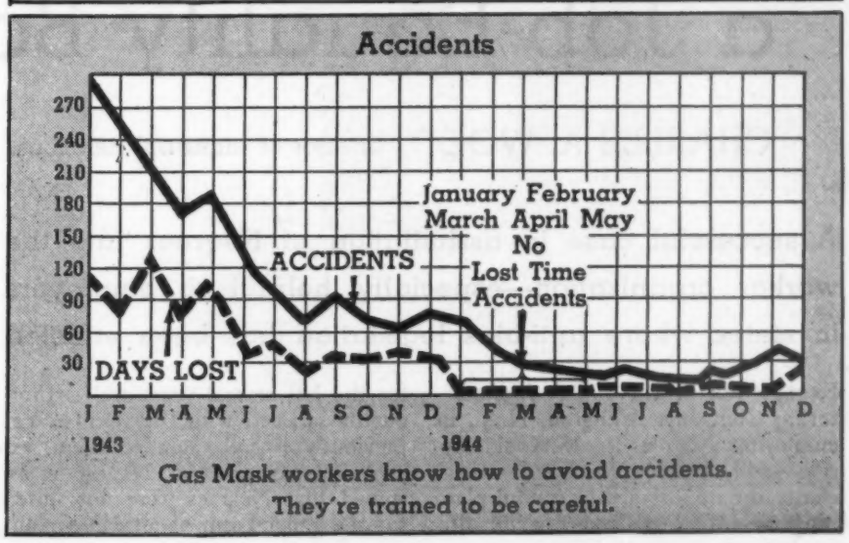
Another feature of the plan was the individual folder supplied to each employee upon termination. This folder contained all the necessary forms and papers needed for unemployment compensation, transfer of hospitalization benefits, and so forth. Also included was an attested individual work experience record, designed to influence each employee to seek the kind of job for which his skill had been developed. This form serves as valid proof of the employee's qualifications and was designed to help secure preferential consideration for the holder. Also in the folder was a set of instructions for the guidance of the employee in interviewing prospective employers, emphasizing neatness of appearance, courtesy, and clear exposition of qualifications.

Long before they were without jobs, the workers were protected against monetary loss caused by their enforced layoff, largely through the efforts of management in early seeking approval of plans for termination pay.

All calls for workers were checked carefully to conserve the job-seekers' time, and machinery was set up to secure quick reports from the employees as they accepted jobs, so that their names could be checked off the lists and efforts could be transferred to still unemployed workers.



They're trained for Quality — as this "reject" record shows.



Gas Mask workers know how to avoid accidents.
They're trained to be careful.

Charts were used to illustrate the broadside sent out by Johnson & Johnson to "sell" its employees, when its own contracts were canceled

When Pollak decided to hire Negroes for jobs that called for more than a "strong back and a weak mind," it first worked out a careful program of educating white workers, indoctrinating the Negroes

Putting Negroes on a Job-Equality Basis

CHARLES A. WOOD, Director of Industrial Relations, Pollak Mfg. Co., Arlington, N. J.

A successful case in assimilation of Negroes into the worker organization—especially helpful to employers in states where anti-bias legislation has been enacted

EXPERIENCE of the Pollak Manufacturing Company, Arlington, N. J., in employing Negroes to work side-by-side with whites shows with unusual clarity the importance of careful planning to introduce and operate this kind of arrangement.

The company has employed Negroes for the last several years and is thoroughly satisfied with the results. Yet previously it had excluded them, except for menial tasks, because it assumed that Negroes were not suited for the general run of jobs in a plant manufacturing precision products.

It was assumed, for example, that Negroes would be quarrelsome, stupid, lazy, and irresponsible; that they would be uncooperative, given to carrying dangerous weapons, and not infrequently afflicted with some kind of disease. In general, management here accepted the supposition that a Negro is intellectually unqualified for any job except a heavy or disagreeable one.

Subsequent experience has convinced management that there is no justification for such general assumptions. But even before the hiring of Negroes was begun, the company rec-

ognized the fact that the assumptions existed, and—whether true or not—created personnel problems which called for skillful handling.

Accordingly, before the company began hiring Negroes for types of work for which they previously had not been considered, a comprehensive program was worked out to establish harmonious interracial relations within the plant and to assure continued efficiency in production. This program was based on certain conclusions from preliminary study by personnel executives. Subsequently the program has evolved and improved as a result of study in actual experience.

Precautionary Steps

First of the basic conclusions of the personnel program which was set up to deal with two-race employment was that care should be taken not only to select and pre-train the Negroes so that they would fit smoothly into their new jobs and into their job relationships with white employees, but also to apply logical persuasion on the white employees to correct possible opposition on their part against the Negroes.

Biggest obstacles to be hurdled, the experience has shown, are the tendencies of white employees to have: (1) A feeling of social and intellectual superiority, expressible in terms of clannish exclusiveness; (2) fear that the Negroes may compete with whites on an undesirable basis at a time of scarcity of jobs.

On the other hand, it was found important to convince Negro applicants for jobs that Negroes as a group would not be confined to jobs involving unpleasant or arduous labor, and that wherever they were placed they would be promoted to better jobs when merited by individual ability without partiality. Also, it was found valuable to win the Negro's appreciation for the management's highly successful efforts to persuade white employees not to expose the Negroes to humiliation or intimidation,

Work habits of the Negroes were studied. It was found that as a rule they are more willing to be shifted in their work, as production needs require, than is usual among whites. It showed also that they have a deep sense of loyalty and response to leadership, lend humor to disagreeable tasks, and are willing to put forth extra effort when it is needed, particularly if their competitive spirit is aroused.

Some faults in the work habits of Negroes were found to be avoidable. For example, some cases of seeming laziness were simply the result of failing to supply sufficient incentive for ambition. Likewise, some faults were caused by factors for which the Negro was not directly to blame. To illustrate, the tardiness that marked the records of some Negro individuals was found to result primarily from inadequate transportation facilities in their residential areas.

The foregoing were the principal considerations in guiding the Pollak management and especially the personnel department in working out the interracial program.

The program consisted of eight main steps, as follows:

1. To assist in the planning and to serve as top personnel executive in direct relations with Negro employees, the Pollak management looked around until it found a Negro who was qualified by character and general training for this keystone job. Incidentally, the search located a considerable number of other college-trained Negroes who quite probably were equally well equipped for this or a similar task. The one who was hired was given supplementary instruction to provide a sound foundation in labor relations.

2. As soon as the Negro administrator was properly prepared he began giving a considerable part of his time to the establishment of friendly relations toward the company on the part of leading figures in neighboring Negro communities. This effort led to a feeling of confidence and respect on the part of members in these communities when opportunities subsequently were offered them to go to work in the Pollak plant.

3. The administrator was made responsible for the personality and work qualifications of all Negroes hired. This did not mean that he had to do the interviewing, but it did require him to set up standards for applicants, and for the conduct and performance of all Negroes who were hired. This procedure in general added further to the growing confidence of Negroes on the payroll and of others in the community, and improved the quality of applicants who presented themselves.

4. To guard against awakening of prejudice among some of the white employees, a program of basic education in interracial problems was put into operation throughout the supervisory ranks. It was made clear to the supervisory staff that management was bringing in Negro labor not only to comply with certain regulations and laws, but also because the management felt it had a moral obligation to fulfill.

Further, the line organization immediately concerned was told that no one department had been selected to

A graduate engineer, this highly trained Negro girl is engaged in tool designing. Careful selection of Negro employees, plus education of white workers, smooth the way to integration of the two races

To assist in planning and to serve as top personnel executive in direct relations with Negro employees, Pollak management found a Negro qualified by character and general training for this keystone job

carry the integration policy alone, but that all departments would be expected to follow, in due course. The point was stressed that objectionable employees —objectionable in relation to either productivity or conduct—either white or Negro, would be separated from the payroll, such separations to be subject to the same tests for all.

Emphasis was placed on what the supervisory staff could expect to get out of sound handling of the questions involved. Thus the important test from the foreman's point of view is the best possible production record within his department, based upon the productivity of each individual without regard to color.

It was made known not only that the integration policy had the full backing of management but also that any white employee who wished to make an issue of Negro employees coming into the department would be let go quietly and without discussion.

However, such firmness on the part of management was timed to follow rather than precede supplementary explanations in support of the hiring of Negroes. The preliminary educational groundwork required was greater in some departments than in others, and it was found best to bring new Negro personnel into the most cooperative departments first.

Once the firm attitude of the management was clear, the number of white employees who threatened to quit was negligible. Only one made good his threat.

5. The labor union at Pollak, an aggressive independent, was kept fully advised of the company's Negro policy, and the union's cooperation was solicited in making the policy work.

6. The sixth step involved the selection of Negroes from among employment applicants and their assignment to various departments.

As a result of this experience, the management here believes it is good practice to bring the first Negroes into a department of about 20 employees. It can be a department that either is being set up for the first time, or one that needs manpower. If it has a high work load, so much the better, because any new employees coming in to ease the burden of work will be appreciated to some extent for that reason alone.

The first department should be cooperatively inclined, but should be neither one of the "de luxe" departments nor the opposite. Also, care should be taken that the first Negroes hired are not assigned to a department

Follow-up visits are made to new employees and their supervisors by two-man teams—one white, one Negro—to "feel the pulse" of working relationships and discover situations that might need correction

where, as a result of other factors, promotions are not likely to occur. To put the first Negroes in "blind-alley" jobs, the Pollak study indicated, would be interpreted by other members of their race as an act exposing subconscious prejudice.

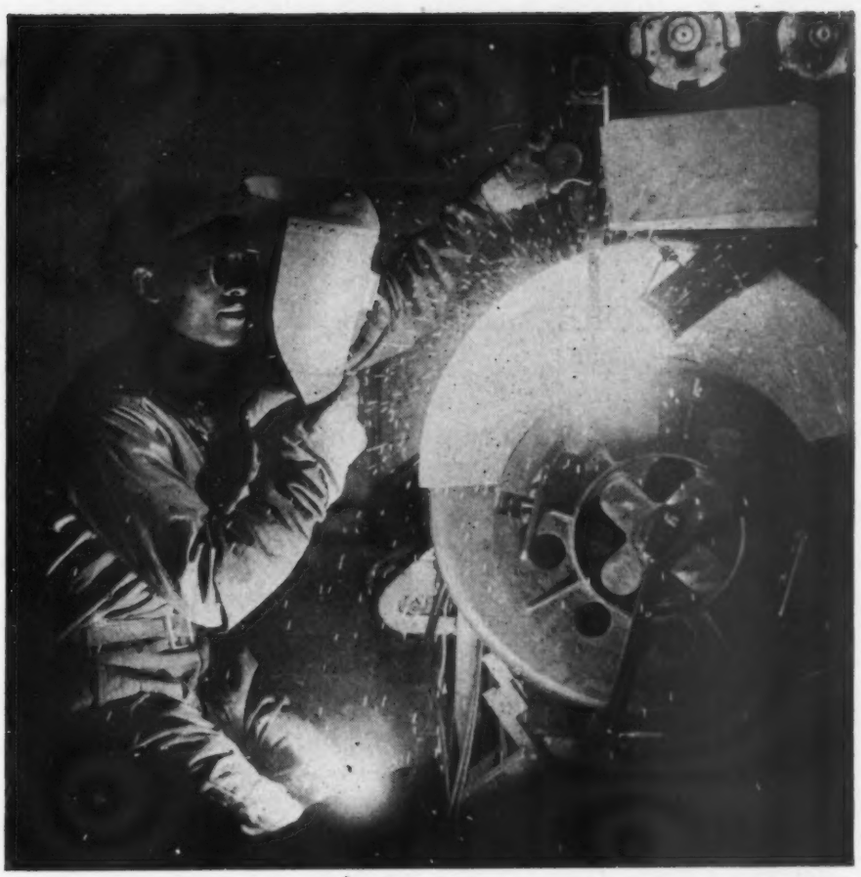
In this company, the first Negroes employed chosen were of such a caliber that it was practicable not to assign them to the poorest jobs in their respective departments, except in departments where, because of the training requirements, it is essential to begin at the bottom and where beginning at the bottom is standard practice.

At first, no more than three and no fewer than two Negroes were assigned to work in one department. This was because it was found that three were as many as the educational program should be asked to support, and because fewer than two would leave a lone Negro worker more noticeable as an "exception" and therefore more exposed to possible unpleasantness.

Great care was taken to assure that the first Negroes assigned to any department had personalities capable of creating a friendly relationship. As far as possible, they were chosen for qualities of Negro leadership. Moreover, the first were carefully indoctrinated, not only as concerns the company, its products, and the job, but also with regard to the responsibility and the opportunity of the first Negroes in a department to make a good impression on behalf of their race. It was found that educated Negroes were especially glad of an opportunity to win a place for themselves on their own merits and at the same time to help create additional opportunities for those who might follow in their footsteps.

7. Having prepared the Negroes and the department supervisory staffs, management's next step was to have a brief, forthright talk with the white employees in the department affected, in groups of not more than twenty, to discuss the company's employment policy, and to ask their cooperation. This lent a tactful approach to white acceptance of management's decision. In some instances, however, exceptions were made. Where it appeared that any discussion of the Negro subject might invite troublesome free-for-all arguments the new employees were simply assigned to their departments without anything having been said to their white co-workers.

8. Follow-up visits were paid to the new employees and to the supervision of their departments to "feel the pulse" of working relationships, and to discover any situations needing corrective measures. These visits were generally made by two persons working as a team—one Negro, one white.



It is important that Negroes not be assigned to "blind-alley" jobs, where advancement is unlikely. Such assignments lead to a feeling of being discriminated against. Here is a highly skilled arc welder

As a further part of the follow-up program, complete records were kept for each employee. The importance of this step was recognized from the fact that, for example, the supervisory staff or other employees in a department might say, in intentional or unintentional error, that Negro employees were doing less work than white workers. In such a case it was evident that the truth must be available in individual production records, so that the issue could be met with facts.

In connection with follow-up, a word about "wedge-plays" is not out of place. An example would be an attempt by an outside labor organization or a rump labor group within the company to challenge the existing collective bargaining agency by winning the Negro employees into a separate group. In any case where a Negro group or any other group is being used in this manner, Pollak management feels at liberty to reach down through available channels to the leadership within the departments and quietly straighten out the matter. Upon occasion, the company has informed union representatives that the company will not take an inactive attitude toward such plays.

But rumors also can act as wedges. Any organization is rife with rumors, of course, most of them harmless. But when any rumors in the Pollak plant require opposing action, it is standard practice to give adequate publicity to the correct facts.

Out of its background of experience with Negroes in an establishment where they had never been used before, Pollak management concludes:

1. That effective development of know-how for operating on a nondiscriminatory manpower basis can raise productivity of all labor to a point where the company is able to absorb readily the initial costs of its know-how program.

2. That if it were possible for more companies to follow such a pattern, the results would not only improve the economic status of the Negro, but also would broaden the base of mass purchasing power for the products of industry generally.

Paperwork for Smooth Flow and Close Control

E. L. MOORE, Production Tabulating Superviser, The Glenn L. Martin-Nebraska Company, Omaha

ACCOUNTING MACHINES have helped The Glenn L. Martin-Nebraska Company build B-29 Superfortresses in less time and at lower cost. The same machines used for payroll and other accounting jobs have been taken to the assembly line as tools of production. They provide an economical method of tabulating and controlling vast quantities of parts and materials.

The production tabulating section is located on the final assembly floor, separated from the conveyor lines only by a chicken-wire stockade. Reports go out strictly on schedule to literally hundreds of key personnel, who use them to direct and control procurement, flow of parts and materials, and installations on the airplanes.

Most of the machines used by the tabulating section are actuated automatically by punched cards, the real basis of the system. All pertinent information is recorded by punched holes in predetermined positions in a card. These punched holes provide the means for assembling or classifying the detail of many transactions into intelligible reports or studies with great speed and accuracy, through the various units comprising an electric accounting machine installation.

Extensive use is made of "master cards"—i.e., cards or sets of cards used repeatedly and maintained on a current basis at all times.

Masters for Various Uses

One set of masters covers *all parts* that appear on engineering prints, and shop production procedure is based on these cards. Another set of master cards represents actual usage *of parts* on conveyor lines according to installation numbers and work positions.

These two sets of parts cards are necessary to cover the range of reports required, since the amount of information possible to record on any one card is limited to 80 columns of alphabetic and numerical information.

To manipulate other types of information, it is necessary only to set up other files of master cards.

A TECHNIQUE FOR PEACETIME PRODUCTION

Let's look first at the parts cards (Figure 1) and see how they are used to build the B-29.

Each parts card has eight items of information punched on it and interpreted across the top. ("Interpreting" simply means printing on the card the information punched therein, to facilitate manual reference necessary in working changes to the file.)

These cards may be quickly machine-sorted in any of eight classifications. As a matter of fact, eight lists or books are made up each month, in which all parts are listed in these different ways:

1. Numerical order, by part number
2. Numerical order, by next assembly number
3. Numerical order, by sections.
4. GFI (Government Furnished items), numerical listing
5. Subcontracted parts, numerical listing
6. Procurements, numerical listing
7. Standards, numerical listing
8. GFE (Government Furnished Equipment), numerical listing

These different indexes of parts are

B 29 PARTS LIST BY PART NUMBER

PART NUMBER	NEXT ASSEMBLY NUMBER
1-02844-0088	15-10766-0023B
1-02844-0088	15-10766-0023F
1-06050	6-16085
1-06050	6-16086
1-06050	9-07154
1-06050	15-10727-0505
1-16656	9-06231-0001
1-16656	9-06231-0001
1-16669	15-12665-0003
1-16669	15-12665-0004
1-16669	15-12665-0009
1-16669	15-12665-0010
1-17872-0001	12-00469-0417
1-17873-0001	12-00469-0417
1-17875-0001	15-09419-0011
1-17875-0001	15-09419-0011
1-17932	15-14905
1-17932	15-14905-0001
1-17989	15-07142
1-17989	15-07142-0001
1-18246	6-15152
1-19001-0074	1-19001-0075

Production tabulating section is located on final assembly floor. From master cards it produces reports that direct and guide procurement, flow of parts and materials, and installations on airplanes

THROUGH PCN 58598 MAY 12, 1945

GROUP CODE	P/M	SHIPS FIRST	AFFECTED LAST	SECT. CODE	REFERENCE
V2P	1	222	374	42	55517
V2P	1	375	*0*	42	54838
W1E	1	1	*0*	44	*53673

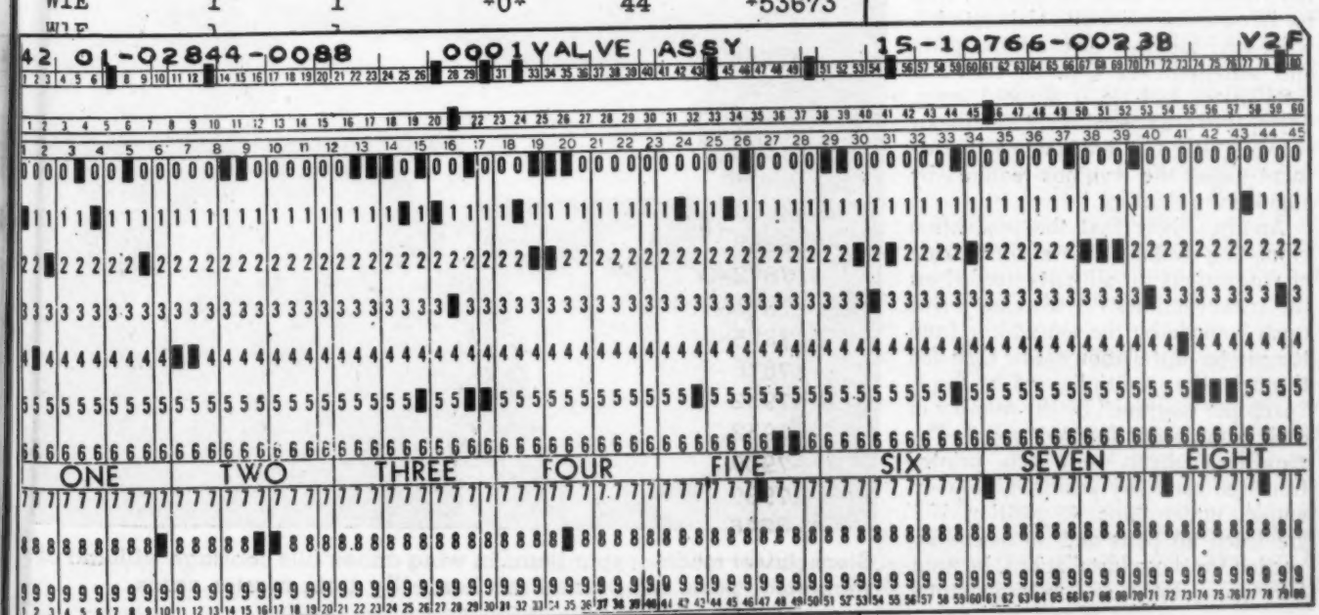


Figure 1. Left, parts list is printed from master cards. Below, parts card for first entry. List is one of eight made monthly from master parts cards

so useful to so many people in the plant that 50 copies are now demanded of the first listing, whose printing runs to nearly 500 pages; 22 copies are made of the third list; 20 copies are made of each of the last five shorter listings. Figure 1 shows a page from Book 1, together with the card from which the first entry was printed.

New uses are constantly developing for these lists, but here's how these major groups use them in production:

1. Project group (including stockchasers): Identifies parts; learns which is the next assembly and its component parts; locates and fills shortages.

2. Specifications group: Checks engineering changes; writes Production Change Notices (PCN's).

3. Stockroom personnel: Distinguishes between current and obsolete parts; makes position "pulls"; shows specific ship for which parts are effective.

4. Scheduling group: Keeps chart room up to date on details; shows parts needed for ships affected according to manufacturing priority, both as to detail and subassemblies; breaks down machine loading for monthly forecasts.

5. Material and inventory control group: Makes up requisition sheets and production folders.

Shop men, too, at Martin-Nebraska lean heavily on the lists, the most useful for them being the "installation lists." These are made up from usage master cards, and are run off for every position on every final assembly line. Each foreman gets a list of all installations he supervises.

The tool engineering department has substituted these installation lists for its own expensive and elaborate job write-ups; the lists give all the parts and subassemblies required for each installation, and *do it without* error. More, they are revised every month. In between, the tool engineering department makes the revisions required by engineering changes.

Another chore that the production tabulating section took was the making of requisitions for all parts needed on the conveyor lines. A working set of cards is made by the reproducer from the master installation cards, then fed through the multiplier to multiply "parts per machine" by the number of each item needed for the "pull." The requistion sheets are then printed from the cards, by positions. For example, under "line 4, position 10," are listed all parts and subassemblies needed for those installations, by number, name, P/M, and extended total, the first and last ship on which the part is used, and the reference number.

Instead of having the project clerk for the conveyor line positions on the floor laboriously make out a list of parts needed for each lot of ships, with constant checking for changes, current lists of all parts used in his position, for the required number of ships, are worked up from a predetermined current schedule. The lists themselves thus become the requisitions. All four carbon copies, with the carbon sheets stapled in place, go to the proper stockroom, where clerks make the position "pulls," usually in quantities of twelve shipsworth. The stockroom clerk notes any shortages on the list and files "shortage" cards. He keeps one copy of the requisition list, sends one out with the delivered parts, another to material control, and the fourth to cost accounting.

Handling Shortages

When the shortage comes in, it is charged in and out of the stockroom, the shortage file is corrected, and the needed parts are hustled to the proper line and position by the stockchaser.

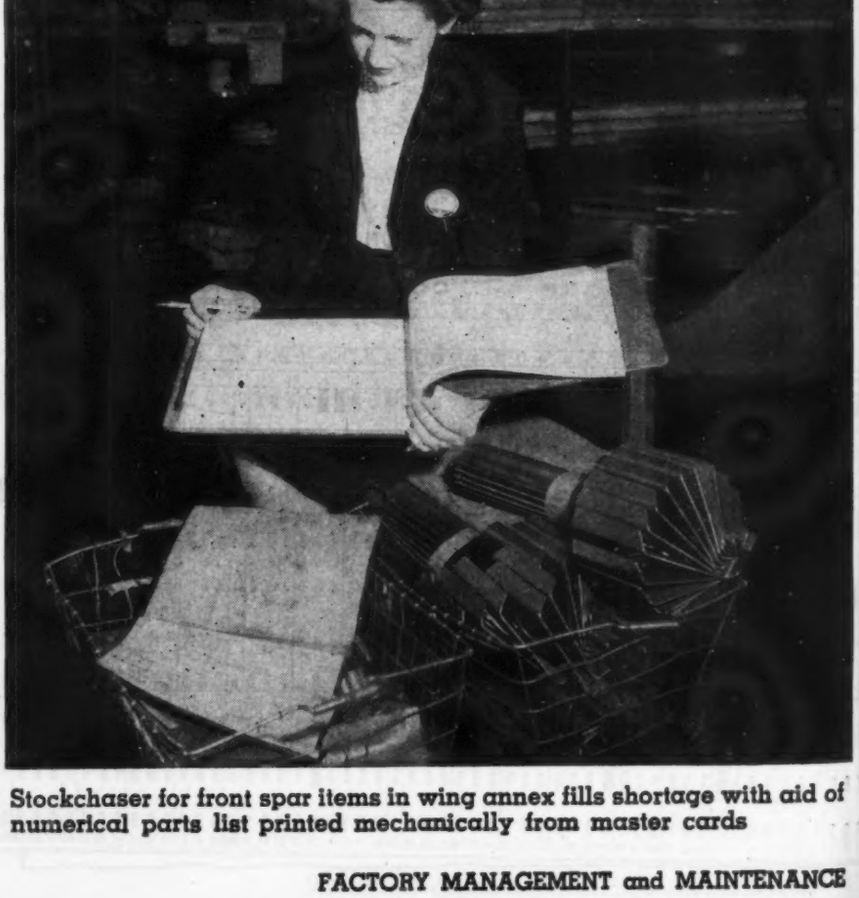
Packaging in final assembly is made infinitely easier, too. The production clerk on the final floor packages one shipsworth of parts for the position he covers, working from his copy of the installation list.

Other jobs come up continually. There is literally no end to the usefulness of the system. Some of the jobs are "one-shot," others develop into regulars.

One of the B-29's crashed in Tennessee recently, badly damaging one section of the fuselage. The AAF wanted a list of all the items in this section. That was easy. The sorter was set for that particular ship section, the cards were thrown in, and all the parts cards for the *damaged section only* were separated in a matter of minutes. That stack of cards was then fed into the automatic printer, and a printed list came out itemizing in numerical order all the parts in that damaged section—and only those parts. A job that would have taken literally days was finished in an hour.

The industrial engineering department was doing a daily labor effectiveness report, and groaning under the immense amount of detail. Tabulating helped work out a simplified master card combining job reporting and labor effectiveness report.

Now cards are pre-punched with



Stockchaser for front spar items in wing annex fills shortage with aid of numerical parts list printed mechanically from master cards

DAILY DIRECT LABOR EFFECTIVENESS REPORT

DEPARTMENT
SHIFT NO.
DATE

THE GLENN L. MARTIN — NEBRASKA COMPANY
INDUSTRIAL ENGINEERING DEPARTMENT

1

Mach. Type	Clock Number	Name of Employee	Delay Code	Daily Hours			Daily Eff.	Cumulative Hours		
				Delay	Budget	Elapsed		Budget	Elapsed	Cum. Eff.
17	10	MCCRACKEN	20	867						
17	10							884	1734	
17	16	RUSH			618	867		1128	1734	
17	103	MOSER			1034	867		1156	967	
17	140	KLINE	20	866						
17	140							938	1449	
17	209	BENALKEN			106	483		193	766	
17	411	WITTER			208	867		472	1708	
17	425	TURNBY	20	866						
17	432	LIPPS			375	867		1121	2042	
17				2599	2341	3951		5892	10400	

Figure 2. Daily direct labor effectiveness report is printed for industrial engineering department from punch-card time tickets, is typical of regular jobs taken on by production tabulating section

name of worker, clock number, shift, and department. The interpreter prints these data across the top of each card, which is then given to the machinist as his time ticket for the day. On the basis of the elapsed time shown, compared with standard times, the industrial engineering department then figures the labor effectiveness for that day for that worker, enters the percentage, and returns the cards to the tabulating section, which key-punches the result and then runs the cards through the printer to get the daily (Figure 2) report for the entire department.

Every six weeks a complete bill of materials is made out, incorporating all new engineering changes. This list (involving, of course, another set of master cards) is of inestimable value to the specifications and ordering group.

Tooling, both new and rework (to keep abreast of changes), bulks large in aircraft fabrication. A weekly tab is kept on all tooling activity, including an up-to-date listing of all TAI's (Tooling Advance Information). These lists require still other master cards, one card being punched for each tool handled by the tool engineering department, whether built in the company's own toolroom or by a subcontractor.

The lists, corrected every week, show the exact status of every tool—whether in tool design, toolroom, or in fabrication outside—and the dates of completion or cancellation.

Briefly, that is how Martin-Nebraska uses master cards and accounting machines to provide production departments with the information they need. Now, how does the production tabulating section turn out the work?

Two for One

First, unless at least two operators can be eliminated some place else for every one added in the tabulating section, the section won't touch a new job. It doesn't pay to tie up the machines unless that ratio is held.

Second, the section knows just what its capacity is. The printer will do 80 lines a minute, for example; the four key-punch machines and four verifiers each average 100 cards an hour, or 400 cards per hour; the three sorters can each handle 400 cards per minute, for a total of 1200 cards per minute.

There are 27 operators, split into two shifts—and *their* capacity is measured, too, thus eliminating as much as possible the variable human element. Every card must be key-punched by one operator and verified by another, who goes through exactly the same motions. If the verifier's punches do not coincide exactly with every hole already punched a red light blinks. Either the verifier or the original operator has made a mistake. This double check on every card virtually outlaws mistakes.

A chart is kept on every key-punch and verifier operator, the department's potential bottleneck. In setting up these performance charts, it is necessary to keep the card load fair. That is because some cards are easier than others; fewer columns are punched. So the girls are charted by actual columns done. A record is kept of their jobs, and is broken down by columns punched. A 40-column job times 800 cards equals 32,000 punches. Another girl may have an 80-column job and 600 cards to do. That means 80 times 600, or 48,000 punches. Each job is then divided by 80 to get a common denominator for charting. The average performance is running slightly over 100 cards per hour per girl.

Busy, But Not Overloaded

Third, work is scheduled on the basis of capacity. The department never runs out of jobs. Neither is it ever hopelessly behind. A simple timetable form of jobs is referred to constantly; it lists all jobs accepted and when they are due out. The section won't accept a job unless it knows that

From requisition lists printed at request of production man on the final floor, position "pulls" are made of all parts needed

it can put it out on schedule. It used not to be this way, before tabulating became an integral part of production, but now the whole factory depends on the lists and the supplements. The section cannot be behind a single day.

A few "WPA" jobs—ones that can be finished any time—are taken on to provide some piecework for odd moments. The vast majority, though, are strictly budgeted.

Fourth, workers are treated and trained carefully. Great pains are taken with the girls; the system is only as good as its operators. The section supervisor has a conference with each key-punch and verifier girl once a week. Her record, charted for the past week, is compared with the average of the other operators, and with her own previous record. This not only gives the girl an incentive for improvement, but it makes merit rating easy.

Fifth, the section continually methodizes, cuts corners. For example: Parts lists have proved their worth many times over. They would be cheap if they were printed on gold leaf. But they are expensive. Every month a complete rerun is made of standard lists, bound into three volumes. Volume I, listing all B-29 parts in numerical order, has 352 pages for a typical run, and its "circulation" is 50 copies. The other two volumes run 22 and 20 copies each, or a total of 92 books a month.

The automatic printer makes four carbon copies, utterly inadequate for the company's needs. That means blueprinting, and blueprinting costs 4 cents a square foot, or approximately 5 cents a page.

Why not use a cheap duplicating method? Experts were called in from duplicating concerns, and one of them came up with the solution—a continuous paper roll for the printer, with a backing sheet coated with a special carbon that transfers a reproducible reverse image to the back of the master sheet as the paper goes through the printer, line by line. This continuous roll is perforated in page-wide sections, and folds itself in accordion "pleats" as it comes out of the printer. The carbon back is perforated along its hinge joint with the master sheet, and is torn off by the operator before she runs off the desired number of copies.

A Hundred Copies

This master sheet will make at least a hundred perfect copies. The saving is a matter of arithemetic: An average monthly run of the three basic volumes comprises a total of 33,656 pages. At 5 cents a page, blueprinting actually cost $1682.80. The same number of pages, allowing generously for the operator and overhead (with the masters costing 12 cents each and the 24-lb. paper $2.50 per thousand) now costs $223, which means a saving of $1459.80 per month.

More, the duplicated lists are printed on both sides of the sheet, whereas blueprinting utilized but one side. Result, a book with only half the bulk—and a saving every month of some 17,000 sheets of critical paper.

The post-war implications are plain in the rapid but sound expansion at Martin-Nebraska of its production tabulating section, which helped the company achieve its record of 28 consecutive months of meeting AAF delivery schedules. Not only competitive conditions after V-J Day, but also the readjustment period itself, with its emphasis on inventories and surplus handling, will demand exactly what the production tabulating department is now developing—economical methods of tabulating, controlling, and manipulating of parts and materials.

EVERY MONTH, AMONG THE ADVERTISING PAGES, these valuable aids to low-cost production: the plant operation man's guide to WHAT'S NEW in EQUIPMENT (page 172) . . . a summary of LABOR DEVELOPMENTS (page 236) . . . things YOU WANT TO KNOW more about (page 224)

MANAGEMENT SHORTS

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary management accomplishments. Accepted articles will be paid for

Six USES interviewers screen terminating Convair employees in company canteen before referring them to on-the-spot employment interviewers from other plants in area. Four out of five employees who availed themselves of service left premises with new jobs

New Jobs on the Spot for Laid-Off Workers

Machinery to bring laid-off employees and would-be employers together has been set up by the Vultee Field Division of Consolidated Vultee Aircraft Corporation at Downey, Calif.

Hundreds of Convair workers had been hit by sudden cancellation of the B-32 program. At the same time hundreds of jobs were waiting to be filled in the Los Angeles area.

Vultee Field therefore arranged for on-the-spot referral by the U. S. Employment Service. Six interviewers from USES set up shop in the company cafeteria along with nine employment representatives from neighboring plants.

Sixty-five percent of the terminating employees availed themselves of this special reemployment service. Of these, 80 percent left Consolidated Vultee premises with new jobs. Wherever possible, the USES interviewers referred workers to similar aircraft jobs where they could utilize the skills and experience acquired at the Convair plant.

•

Central Dispatch Keeps Parts Moving

A new dispatching system set up in the Boeing Aircraft of Canada factory at Vancouver makes maximum use of mobile transportation units by providing an effective means of communication between drivers and the central dispatching office.

No walkie-talkie equipment being available, the company did the next best thing. Signal lights controlled from a switchboard in the factory office, which provides a view of most of the working floor, call truck and tractor operators to telephones connected directly to the switchboard. Drivers can thus be reached on a moment's notice and dispatched on new errands. Crane operators can also be reached by direct telephone from the dispatching office.

•

Adds "Fix-It Party" to Recreation Program

For employee groups looking for something different in entertainment, there's the "Fix-It Party" as staged by YMCA and YWCA member-employees of General Electric Company's general office, Schenectady, N. Y. These Live Y-ers, as they call themselves, pool their skills and tools to have a big evening of just fixing things.

Girls bring sewing kits, darning needles, etc. Boys bring their hammers, pliers, and other tools. Each member brings something to be fixed.

Result: A lot of buttons sewed on shirts, irons repaired, socks darned, toasters put back in good condition.

Phonograph records supply music. Each member brings a lunch, which simplifies the food supply problem.

•

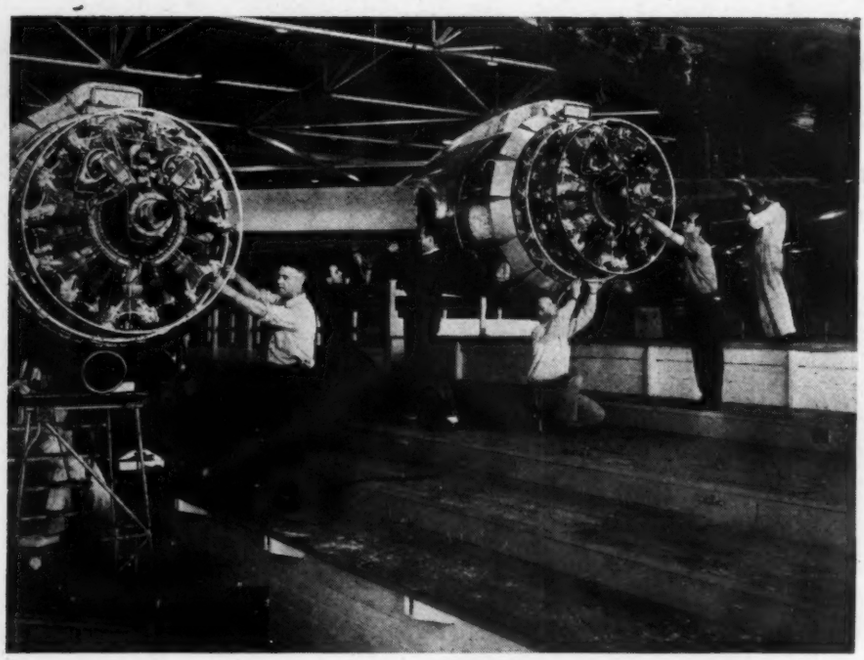
Assembly "Stairway" Saves Man-Hours

When word reached Douglas Aircraft Company, Santa Monica, Calif., that production on C-54 Skymasters had to be increased 250 percent, an entirely new setup had to be planned, particularly in the final installation division, to keep up with the flow of airframes moving from the regular assembly line.

Practically 117 feet of wing length had to be worked on by as many as 50 men simultaneously. Wing tips to be installed, engines to be adjusted, and many smaller installations, were only some of the problems to be considered. To handle this work quickly, and with a minimum of fatigue to the worker, Douglas planners designed huge stationary platforms.

The platforms are styled much like a stairway, affording several floor levels. The various levels dispensed with movable platforms and eliminate cramped working positions. The steps vary in width and height to furnish proper levels at working stations; and a given job may always be accomplished at the same position.

The combined length of the double assembly line is 1350 feet, and the plat-



Assembly lines built like a stairway provide proper levels at working stations and eliminate cramped conditions. Electrical and air outlets are provided

forms cover an area of 60,000 square feet. A stockroom for parts, 475 feet long, was built between the two lines, with an additional 175 feet of space provided under the platforms for stock and pre-assembled parts.

Electrical and air outlets are located at convenient intervals. Electrical trolley ducts mounted on the landing gear ways are a moving source of power for work inside the fuselage and on test stands. Automatic sprinkler systems were installed for fire protection.

Approximately 50 percent of the man-hours have been saved since the line was built—one of the largest contributors to this saving being the stationary platforms.

•

Painting the foundry white, except for a green border near the floor, so increased production at American Boiler & Foundry Company, Milan, Mich., that the improvement was paid for out of the profits of the greater output.

•

Loose-Leaf Notebook Aids Foremen

HENRY NICHOLSON, Education Director, Hickok Manufacturing Company, Inc., Rochester, N. Y.

LOOSE-LEAF notebooks, 8½x11 inches, have recently been given to foremen at Hickok Manufacturing Company, Inc., Rochester, N. Y. These books provide the foremen with useful information, bind them closer to management and to each other, and help them develop themselves in their work.

The note book has five dividers with index tabs inserted which classify the material that goes behind that divider. The sections and the material which is to go in them are as follows:

Rules and Procedure: Notices as issued by the plant manager which are of long-time or permanent significance. In time these will be codified and developed into statements of company policy.

Supervisory Progress Data: A series of foremen's conferences was recently held on ten elements of supervisory progress. Notes on these meetings and the foreman's own copy of a supervisory progress report which he sends in weekly to management on progress he has made in any of these elements, are contained in this section.

Hickok Foremen's Letter: The education director writes and distributes a letter monthly to supervisors and foremen. It generally ties in closely with matters and problems which are current in the company.

Departmental Notes: Sometimes a bulletin or informational material is issued that pertains to a particular department rather than to the plant as a whole. It is kept in this section by the foremen concerned. Several blank sheets and several ruled sheets are inserted in this section for the foreman's own notes that he may wish to keep.

Miscellaneous: This section is to contain items which an individual foreman may find of value and wish inserted in his own particular book, or general items that may not fall within the scope of any of the above four headings.

Answer to question "What is a Suggestion?"
A Suggestion is a
DEFINITE
PROPOSAL
intended to be of benefit
It will change our way of doing things and may be something NEW and ORIGINAL or a new application of an old idea

Inexpensive posters are used at Illinois Central Railroad's shops to stimulate the flow of worker ideas. One of them is illustrated above. Another bears the message, "Everybody gains from a smart idea, and it is our responsibility to encourage smart ideas by handling every suggestion expeditiously with painstaking thoroughness. Since ideas are responsible for all progress, the letters I-D-E-A have been used to remind us of our responsibility in handling suggestions: I—Investigate; D—Deliberate; E—Evaluate; A—Advocate"

MAINTENANCE SERVICES

Effective plant maintenance lowers unit product cost

SELECTION • INSTALLATION • INSPECTION • UPKEEP • ORGANIZATION

CONTENTS OF THIS SECTION

Editorials 142
Modernizing an Old Plant for Low-Cost Production *Fleming W. Johnson* 143
Foremen Schedule Their Own Maintenance Work *Elmer A. Munson* 148
Better Welding Grounds Stop Shock Hazards....*A. S. Durkie and K. G. Millington* 150
Third-Shift Repairs Save Machine Downtime.....*W. L. Georgen* 152
The Cost of Maintenance in Seventy-Five Industries.. following page 152
Saving With Rechargeable Flashlight Batteries.....*M. A. Raney* 153
Now Cleans Floors Faster .....*Victor C. Hoffman* 154
How to Make Insulation Resistance Measurements *Graham Lee Moses* 156
Mechanical Power Transmission Equipment 162
Maintenance Shorts 164
Data Sheets: Driven Shaft Speeds 168
What's New in Equipment 172
Catalog Service 322

MAINTENANCE CONTENTS OF THE THREE PRECEDING ISSUES

JULY

Standardized Materials Cut Plant Housekeeping Costs *H. M. Bradley* 129
Cheaper to Remove Blackout Paint Than to Reglaze *Martin J. O'Mara and Edgar M. Brennan* 132
Underground Factory Saves Fuel and Upkeep Costs..... 134
Windings That Resist Heat.....*G. A. Van Brunt* 136
How to Move Machines.....*G. R. Leggett* 139
Getting the Most Out of Solid Rubber Tires....*H. W. Detzell* 144
When and How to Switch Capacitators Automatically *W. H. Cuttino* 148
Building Materials 154
Maintenance Shorts 156
Data Sheets: Circumference and Area of Circles..... 160
What's New in Equipment..... 164
Catalog Service 278

AUGUST

Provide Management Controls..... 164
Case of Dravo Corporation

SEPTEMBER

Production Methods Applied to Plant Maintenance *R. F. Bartlett* 133
Service Methods That Cut Fluorescent Lighting Cost *Joseph W. St. Andre* 136
Planning Whether to Repair, Replace, or Add *F. R. Weaver and H. C. Atkins, Jr.* 140
Attendance Chart Spurs Maintenance Efforts....*Wiley Craig* 142
War Production Committee Lends Aid to Maintenance *V. H. Verby* 143
How to Plan Plant Distribution Systems.....*D. L. Beeman* 145
Clean Equipment Safely.....*W. H. Easton* 150
Snow Removal Methods That Keep Plants Open *James Montagnes* 152
Unit Heaters and Ventilating Equipment..... 156
Maintenance Shorts 160
Data Sheets: Connection Diagrams for Electrical Instruments 164
What's New in Equipment..... 168
Catalog Service 290

CHANGE OF ADDRESS

McGRAW-HILL PUBLISHING COMPANY
330 West 42nd Street, New York 18, N. Y.

Director of Circulation:
• Change my address on Factory Management and Maintenance

Name .....

Old Address .....

New Address .....

New Company Connection .....

New Title or Position .....

FACTORY MANAGEMENT AND MAINTENANCE
McGRAW-HILL PUBLISHING COMPANY, INC., 330 WEST 42nd STREET, NEW YORK 18, N. Y.

MAINTENANCE as the Editors See It

Give Fire Prevention Your Top Priority

EVERY DAY IN THE YEAR, according to the National Fire Protection Association, about 100 factories have a fire. Some of these blazes are comparatively insignificant, involving rather small losses and production delays that do not disrupt schedules too badly. Many other fires, unfortunately, destroy a large part, or all, of the plants in which they occur. Lives may be lost. Some workers may be badly burned or injured. Raw materials, finished stock, plant equipment may be destroyed in amounts that run into the millions.

The deplorable fact is that most fires need not occur; they result because someone blundered. It is also true, and equally deplorable, that losses from the fires that do occur would be greatly reduced if suitable precautions were observed at all times and emergency situations were properly handled.

A vast amount of tested information is available on fire prevention and firefighting. Highly effective equipment can be had for combating fires. There is often failure, unfortunately, to make use of these weapons.

Changes in layout and methods, adoption of new materials, shifting of employees, manufacture of new products, may create new hazards, or increase existing ones.

Time could hardly be spent to better advantage than in making a thorough study of the fire hazards in your plant, minimizing them as far as possible, and making sure that if a fire breaks out it will be promptly and skilfully handled. Then see that these conditions are maintained.

Base Maintenance Budgets on the Plant's Needs

THERE IS ALWAYS an actual need as well as a strong curiosity to know how much the other fellow spends for maintenance. The data on the insert that follows page 152 of this issue will be quite serviceable in both respects.

Various bases are used in setting up budgets or allotments for maintenance expenditures. In some plants, for example, expenditures are based on plant activity, as expressed in the number of hours of operation. Past records may be used to gage future expenditures. Or budgets may be based largely on a careful study of the condition of plant equipment or buildings, and the work that will have to be done on them. Probably more often than not all these factors are combined in varying degrees, in estimating costs.

The difference between the highest and lowest maintenance expenditures in an industry group is sometimes greater than might be expected. There may be several reasons for such figures.

The age, condition, and kind of plant and its equipment seriously influence the amount of maintenance attention needed. Accounting practices in the allocation of charges are by no means uniform, a situation that makes exact comparison of maintenance costs difficult.

There is little likelihood that any plant spends too much for maintenance, except in the sense that money may be wasted through slipshod methods and shortsighted policies. The chances are much greater that many plants do not spend enough to secure maximum return for every dollar.

Comparison of one's maintenance costs with those of other comparable plants can be very helpful. It is to be borne in mind that the principal value is in the indication of variation from average. At bottom, a maintenance budget ought to be based solely on a plant's needs, not on what some other plant spends.

Keep Future Needs in Mind When Planning Plant Services

ONE OF THE MISTAKES that is frequently made when installing new pipelines is failure to provide sufficient capacity for increased loads. The capacity needed for present loads is estimated and some margin is allowed for heavier loads, based on the best guess that can be made at the moment. The chances are pretty good that this guess will be too conservative.

Therefore within a comparatively short time the lines, particularly those carrying water or compressed air, may not be large enough to serve satisfactorily.

These same things can be said altogether too often about electrical power lines.

Hence production is put under a handicap. As is usually the case, prevention of such conditions is likely to be much cheaper than cure.

One plant engineer who has learned some of these things the hard way has also learned how to avoid such situations. With some minor exceptions it is his practice when laying out pipelines to put in from one and a half to three or four times the capacity called for by the estimates of the immediate or likely loads. While this practice increases the original cost, the extra expenditure almost invariably is more than justified later.

It is also his practice to put in tees at all points where branches are likely to be taken off later. Again the original cost is increased, but afterwards the time and expense of breaking lines or running long branches are saved.

There are few, if any, instances where careful planning and foresight will produce greater returns than in designing service facilities.

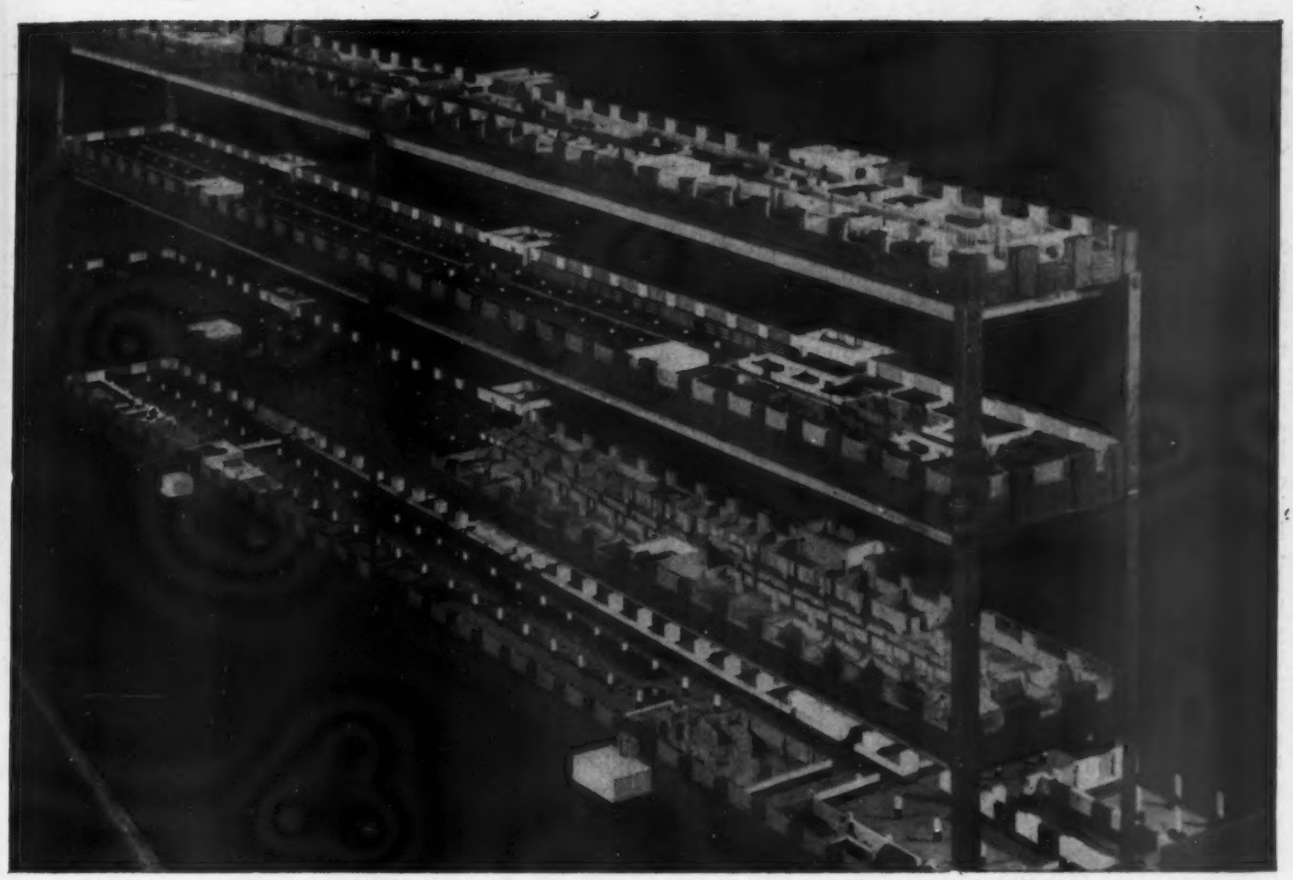


Figure 1. This scale model made it possible to visualize layouts beforehand and thus prevent costly mistakes. Layouts were first drawn on paper, but actual placing of equipment was held up until the model was made and studied. Duplicate models of the corporation's plants are kept at headquarters

Modernizing an Old Plant for Low-Cost Production

FLEMING W. JOHNSON, Vice-President in Charge of Manufacturing, Eastern Division, International Detrola Corporation, Detroit

THE MODERNIZATION PROGRAM described here was carried out in a 4-story structure built in 1917 as a foundry. This building is 650 feet long. The first floor is 120 feet in width and the remaining three floors are 60 feet wide. In planning the program, extensive use was made of the scale model shown in Figure 1, in making the layouts of the floors. The engineering offices are on the fourth floor, the main offices occupy about half of the second, and manufacturing departments the rest. Everything is made to scale, which permits ready visualization. At the start of the revamping job the layout was made on flat drawings in accordance with the basic layout ideas mentioned later. Then these drawings were converted to scale models, because it is easier to discuss arrangements with line supervision from models than from drawings; and supervision was consulted before the actual building layouts were made.

FOR LOW-COST PEACETIME PRODUCTS

Incidentally, models are used in all plants of the corporation. Duplicates are kept at the central office. A change in the location of a department, or of a machine or piece of equipment, must clear through the central office. To be sure, local managers know their problems intimately, but the requirement that the change must clear centrally in-

sures that constructive thought is given to the problem. Also, models with all equipment numbered help in building up and keeping equipment and accounting records.

Architectural features of this building are typical of those in vogue in 1917. Exterior walls are face brick. Steel columns and cross members are I-beams. Floors are wood, consisting of 2x6-in. planks placed on edge and overlaid by hard maple, in the upper three stories.

After the First World War this building was adapted by another company to the manufacture of radios, but this adaptation was far from what could be considered modern practice in radio assembly manufacturing, as far as making the building an efficient manufacturing tool is concerned. The flow of material was not in a straight line, and zigzagged from floor to floor. Some 80 percent of the parts used were kept on the manufacturing floors. The layout made it impossible to visualize what was going on. Assembly tables were long and short, and placed in diverse directions. Figure 2 shows a sample of the crowded conditions under the old layout. It is obvious that supervision had a difficult, virtually impossible, task in keeping track of what was going on. A worker might or might not be working effectively; might, in fact, be away from her workplace for some time without notice.

Again, notice the home-made character of the table, particularly tthe awkward arrangement of legs and supports into which the workers had to fit their knees and feet. The ceiling is a confused mass of hanging wires, cords, light fixtures, and materials handling tracks. In short, the atmosphere is not conducive to worker contentment and efficiency.

No More Confusion

Figure 3 is a view of one section of the present manufacturing space. Here, cluttered confusion is absent. The ceilings are clear of obstructions. The flow is straight, and the pattern of movement is evident from a distance. Workers have a feeling of spaciousness, of orderliness.

Revision of facilities, such as is evident here, was based upon tested theory, because reconditioning is not just a matter of clean up and paint up. Steps taken had to fit into a pattern that experience indicated would result in efficient manufacturing. Frills, for the sake of frills, had to be forgotten.

Changes made in revamping the old layouts were based on these principles:

1. The steps taken must fit the eventual flow of the work.

2. Movement of work from operators should promote quality.

3. Suddenly developing difficulties in the flow of work must be immediately evident to supervision.

4. It ought to be evident to the workers that management has respect for the physical part of the plant.

5. Large, clear spaces devoid of confusion have a comforting influence on the mind of the worker.

6. Each work center must have enough space and light.

7. Each worker should have just enough to do to balance her work with the preceding and following operations.

It was recognized also that the reconditioned building should be easy to maintain.

To begin with, a market analysis determined the load on the plant. That is, from this analysis it was determined

Figure 2. This department, with its cluttered-up ceiling, inefficient worktables, chairs of incorrect height, and general disorder, is typical of conditions before the modernization program was undertaken

Figure 3. The new assembly tables were carefully designed for maximum worker efficiency and comfort. A double row of 40-watt fluorescent lamps in the trough above the table provides 60 foot-candles on the work. The chairs shown here have since been replaced with the type shown in Figure 5

that an output of 60 per hour of one type of radio set would be required and, say, 90 per hour of another type.

The production engineer adapted the engineering designs to economical manufacturing practice.

The industrial engineer then determined the operations required, the method and tools to be used on each operation and the time required for each, trained the workers, and calculated the cost. It is his job to balance each operation with all others in a line, to avoid bottlenecks.

Operators Trained on Job

When a new radio set is started down a line, the industrial engineer who set up the operations instructs each operator in turn. Also, he trains the relief operator in all the operations performed by the 12 to 15 operators she relieves.

It might be well to point out that the workers are informed at the start what the line speed is to be; then no one is mentally set to accept a particular level as "pretty good." Training in the vestibule school and on the line is keyed to the rate of output that methods and time study indicate can be maintained. This principle is important, because it is a factor in space arrangements and assembly table length.

To show how these ideas were worked out let us begin with the building ceilings and floors.

Instead of replacing the worn maple floors, it was decided to lay asphalt tile over them. This covering is waxed each week with a non-slip wax. All materials handling carts are rubber-tired to minimize wear on the floor.

The absence of stock in and around the work areas and on the floor is plainly shown in Figure 3. Parts are brought from the stockroom, Figure 4, in definite amounts and at different times and placed in pans, which are tilted at an angle for convenience, in front of the operators. Finished products are taken from the ends of the lines immediately to the shipping room. Banks of parts between operations are not necessary.

This means that the floors are clear of obstructions, such as piles of material. They can be cleaned easily, and the workers are not confused and irritated by cluttered conditions, nor are they encouraged to create confusion by putting material where it does not belong.

Aisleways are marked by different-colored tile, which is distinctive and pleasant in appearance, and a factor in mental contentment.

Walls in the manufacturing departments were reconditioned to match the floors. To a height of 4 feet, they are painted a vista green. The same color is used on the windows. The stockpans in front of the operators also are painted green. The eyes of the operators are at no time exposed to glare from windows, or from sunlight reflected from stock containers at their workplaces. Hence eyestrain is avoided, and quality is better.

Green paint was applied also to the stair wells between the four floors. Elevators are available at the ends and in the center of the building, but operators have to walk between floors. A 2-in. orange-colored band is painted on each side of the treads and on the rounded nosing of each tread.

Reconditioning of the ceilings was comparatively simple. Everything except the sprinkler piping was taken down and the ceilings were painted white, as Figure 3 shows.

Efficient Assembly Tables

The assembly bench is significant in the plan of reconditioning; in fact, it is the assembly table and what goes on there that serves as the reason for the whole program. It will be observed, Figure 3, that the assembly line tables are arranged along the two rows of columns. In fact, they are anchored to them. Between columns the tables rest on two Y-shaped supports, the base of which is cut through the maple floor to the 2x6-in. base planks. The arms of the supports extend up and outward to give rigidity to the table. The space for the workers' knees is therefore free of table legs. Also, snagged stockings are not mental hazards—a not unimportant factor in worker satisfaction.

Tables are constructed of two angle

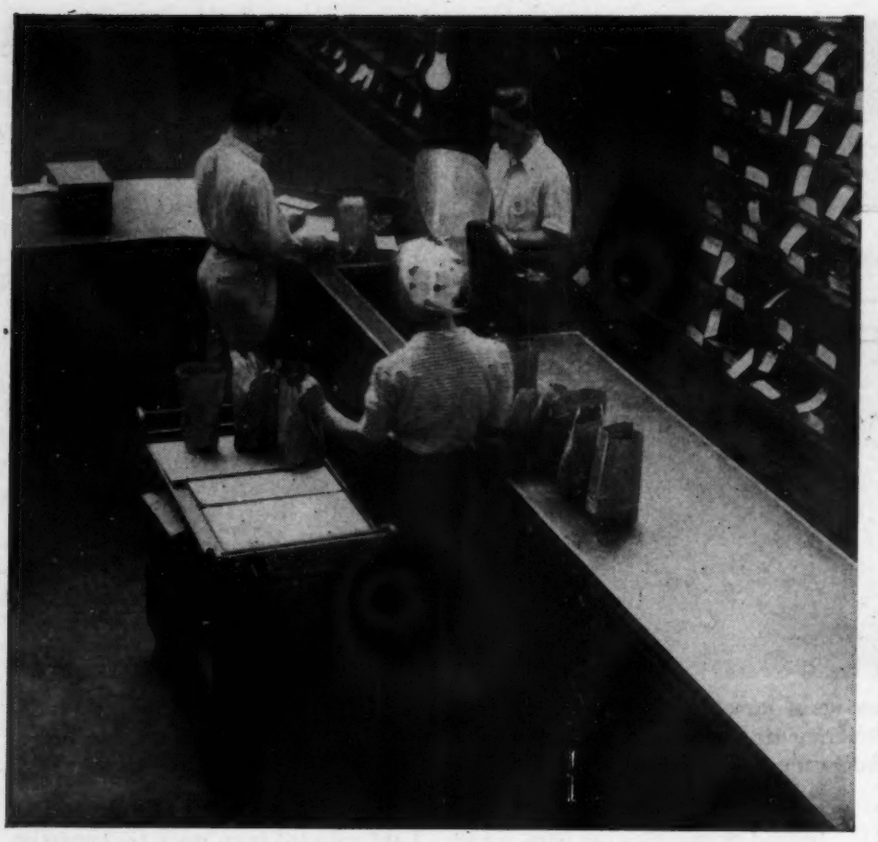


Figure 4. Good layout, neatness, and order also characterize the stockroom. Supplies of parts are delivered to the assembly departments at regular intervals on one of the rubber-tired carts shown here

irons mounted 31 inches from the floor. The tops are made from 2x6-in. yellow pine running lengthwise and covered with dun-colored pressed wood, which is shellacked periodically. The table height is such as to permit standing or sitting.

This change in position from time to time, experience demonstrates, results in increased output and greater worker comfort.

The length of the table is determined by the industrial engineering department in view of the operations involved. If one side of a table does not afford enough room for the operators required, the table is curved around a column and the opposite side of the bench used.

Comfortable Seating

Each operator is provided with 32 inches of space along this table, and she has an adjustable chair, Figure 5, with a folding foot rest. Above the tables is a continuous light trough containing two rows of 40-watt fluorescent tubes, designed to furnish 60 foot-candles of light on the working surface. Power lines are run down the columns and under the tables.

Since the industrial engineering department divides the jobs so that the

Figure 5. Stockpans conveniently placed in front of the operators are painted green. Chairs are form-fitting and adjustable, with a foot rest that can be let down or turned up as the operator wishes

Figure 6. Benches on which purchased parts are inspected look modern, and are. The individual fluorescent lighting fixtures give ample light for the task, right where it is needed

time content is the same for each operation, trains the workers in proper methods, and provides a relief worker for a definite number of operators, there is no need for banks of parts between operators. What may be called the push-along system is used in getting work from operator to operator.

Light sets are slid along on angle irons, on the table top, or on dollies as the weight and size of the set dictate. Push-along time is allowed for in setting the line capacity. In one group of 37 operations this time allowance amounts to about 2 percent of the total.

Wide Aisleways

Two rows of columns divide 60 feet of building width into three areas. With two lines of assembly tables attached to the columns, aisle widths of 12 feet are provided. Although this particular space distribution is conditioned by the building width, experience indicates that wide, clear aisleways result in an increase in production of as much as 25 percent. This result is a combination of several factors. For example, wide aisleways do not encourage loitering or leaving the job unnecessarily. The clear space enables supervision to see what is going on, and to spot a tie-up in work flow a long distance away from the point of trouble. Also, maintenance is made easier. In fact, janitor service is one-fourth of that required before the reconditioning of the plant. With these large, clear spaces and long, unbroken lines of light troughs and tables, and the elimination of glaring contrasts that are irritating to the eye, operators are not confronted with confusing and irritating conditions.

Figure 6 shows the type of benches used in the inspection of incoming purchased parts. These benches have been designed for convenience and case in handling and inspecting parts. Each bench has its own fluorescent lighting fixture.

Electrical power distribution in the building had to be completely replaced, because constant voltage could not be maintained for testing, which is a prime requirement for quality manufacturing of radios. Light and power lines formerly were run in separate conduits from the transformers. Drop cords were used to bring power to lighting fixtures, power tools, and soldering irons. This arrangement was responsible, of course, for the cluttered condition of the ceilings to be observed in Figure 2.

The old power distribution system was torn out and arrangements were made to supply the main building by one 333-kva. and two 100-kva. 4800/240/120-volt single-phase transformers connected in closed delta for light and power loads. Distribution is by means of bus duct feeding through a totally enclosed circuit breaker board located in the one-story section of the first floor.

The bus duct is three phase, with solid neutral. Power for motors or lights may be taken off at any point. The bus duct, enclosed in a rectangular wire screen, runs the length of the first floor ceiling. Three risers to the upper floors terminate in cubicles on each of these floors. From the cubicles the distribution is through a panel, along the ceiling to the building columns, and then down and under the tables for its entire length. Power tools may then readily be plugged into the under-the-table duct.

Modern Facilities

In the offices and drafting and engineering departments, however, it was necessary to go further than in the assembly departments, to provide efficient working space. With 14-ft. ceilings, it was feasible to build modern facilities into the existing building shell. Perforated concrete-asbestos boards backed by wool batting were installed to provide an accoustically treated ceiling. The sidewalls were covered with corrugated concrete-asbestos sheets. The floors are covered with asphalt tile. The new ceilings are 12 feet high in the engineering departments, which provides enough space between the old building ceiling and the new noise-proof ceilings for air conditioning ducts.

Foremen Schedule Their Own Maintenance Work

ELMER A. MUNSON, Plant Engineer, Gould & Eberhardt, Inc., Irvington, N. J.

MAINTENANCE FOREMEN at Gould & Eberhardt, Inc., tell their plant engineer every morning in a written report what major jobs they have scheduled for that day. This deviation from accepted maintenance practice is justified by the following results:

1. More efficient utilization of manhours is obtained, because foremen can fit the jobs to manpower and work conditions best known to themselves.

2. Work is reduced for the plant engineer, who is relieved of detailed planning that is better done by his maintenance foremen.

3. Maintenance foremen rise to the responsibility of planning their work, and are more conscientious in trying to meet their schedules.

Hand in hand with this unusual method of work scheduling is the operation of a one-sheet work-order system. This system provides the plant engineer with the means of indicating to his foremen the relative importance of each job, yet enables him to relinquish to them the more detailed duties of daily planning. Two basic rules govern the system's operation, (1) no maintenance work can be done without a written order, and (2) all orders are subject to executive review and approval.

Only One Order

Here is how one piece of paper, without duplicate, succeeds in accomplishing these objectives of controlling and scheduling work in a maintenance organization totaling approximately 40 men. To begin, all requests for maintenance work, oral, written, or telephonic, are channeled to the work dispatch clerk in the plant en-

MAINTENANCE DEPT. WORK AUTHORIZATION

REQUESTED BY D. A. LINDSAY DATE AUG. 6, 1945

DEPT. 2 CHARGE ORDER NO. 39 B. E. 10

Class of Work	WORK AS FOLLOWS:
CARP.	REPAIR STEAM LEAK
ELEC.	NEAR A.C. ROOM
MECH.	URGENT
(PIPE)	
RIG.	
LAB.	
MASON	
PAINTING	BY E. A. MUNSON

Figure 1. Simple 3x5-in order form, without duplicate, is used to authorize all maintenance work. Note that date wanted is not included in details, because scheduling of other than urgent work follows date of order consistent with most efficient planning

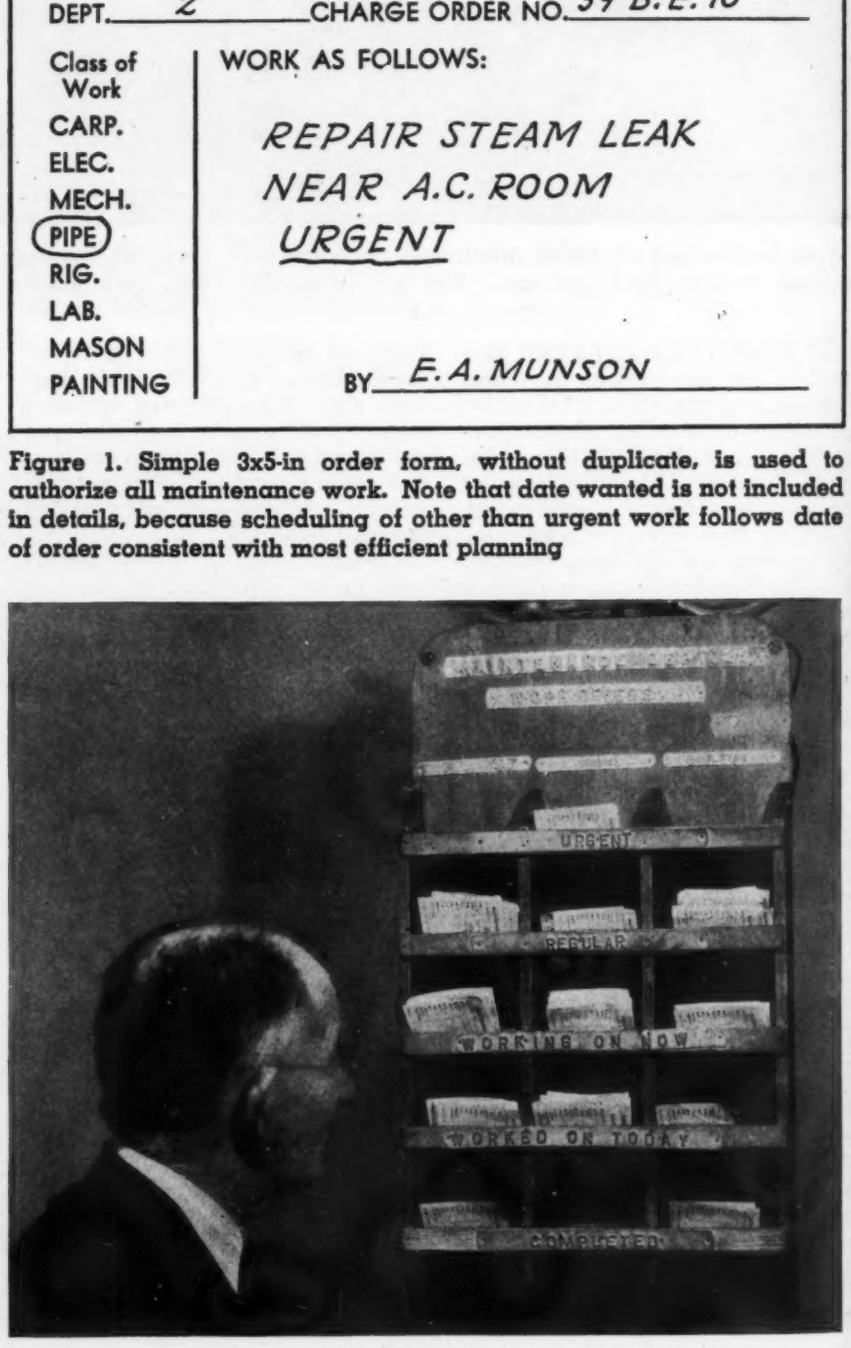


Figure 2. All active maintenance orders for various maintenance sections are kept in this rack, which is partitioned to hold new orders, work-in-progress, and completed orders

gineer's office. A white work authorization (Figure 1), 3x5 inches, is written out, giving all details as to what is to be done, who is to do it, when and where the job is to be done, and the account to be charged on material and labor records. No order number is involved. If necessary, detailed specifications and blueprints are attached.

After receiving the necessary approvals, the new order is placed promptly in a special wooden rack located alongside the maintenance timekeeper's desk, from which it is never removed until completion of the job. This rack (Figure 2) has three vertical rows of five partitions each, one row for use by each of the three maintenance groups headed by a foreman, that are captioned "Electrical," "General," and "Pipe." The five horizontal rows are marked, from the top downwards, "Urgent," "Regular," "Working on Now," "Worked on Today," and "Completed." All new orders are inserted either in the "Regular" or "Urgent" partitions of the appropriate maintenance division scheduled to do the work, making it easy for the foremen to spot the urgent jobs.

When a job is assigned to workmen by a foreman, he writes the names of the men and starting time on the back of the order, and places it in the "Working on Now" partition. When the job has been completed, the time is again marked by the foreman on the back of order, and the order is signed and placed in the "Completed" partition. If the work is temporarily interrupted, as may occur when urgent work intervenes, the time of stoppage is noted on the order, and the order is placed in the "Worked on Today" partition. This partition is particularly needed by the time clerk, in his duties of transferring all time data from active and completed orders to time cards for each man for each separate job, to permit a daily reconciliation of total hours worked. After serving the timekeeper, completed orders are returned daily to the plant engineer's office for filing. Interrupted orders are returned, however, to the "Regular" partition for renewed assignment.

From 300 to 500 work orders per week are being handled successfully by this order system. The possibility of losing an order is remote, but should one become lost, the timekeeper inevitably discovers the loss, because he must have a charge number for every job and every minute of time expended. Whenever the plant engineer needs to review the backlog of active orders, he always can refer to the order rack, which accurately shows their current status. The occasion for this is so infrequent it does not justify the effort of keeping a duplicate set of orders in the plant engineer's office.

This order system obviously makes the maintenance foreman responsible for the sequence in which work assignments are made, which is exactly what is wanted. But the plant engineer is still responsible to see that "first comes first." Moreover, he must always know what is going on to be able to discuss plans and problems with management and production executives. Both objectives are satisfied by the use of daily written reports from the foremen, who bring them in personally to the plant engineer's office within the opening hour. These reports are made out immediately after all work for the day has been assigned by the foremen to their workmen. In this way, all absences are accounted for, and the plant engineer is kept advised of who has failed to report, and why certain jobs must be delayed.

Date AUG. 6, 1945

DAILY WORK SCHEDULE

Maintenance Dept. 25 — Electrical Division

Name	No.	Job	Dept.	Charge No.
McDonnell	FF 3	Supervision	25	25E5A
Roehrich	FA16	SUPERVISION & INSPECTION-ROTARY		
ROOM-BOILER-		BURNER-CONTROL & WELL		
Kuchler	2588	PIPING & WIRING	4A	3805A4
		72" GEAR CUTTER		
Cupka	2590	INSTALLING POWER	4	X1916
		RECEPTACLE-DUCT		
Knierim	2592	INSTALLING POWER	4	X1916
		RECEPTACLE-DUCT		
Matus	2594	REPAIRING EXTENSION	10	10 E 26
		LIGHTS		
Rock	2586	OUT SICK	-	-
Snyder	2593	CHECKING & REPLACING	41	39A E 26
		LIGHTS-MAIN OFFICE		
Hertlein	SC3	CLERK	25	25 E 26

Figure 3. Each maintenance foreman efficiently plans his own daily work schedule from orders on hand, and submits written schedule to the plant engineer early each morning for approval

A Daily Report

For making out the daily report, the foremen are furnished with a letter-size sheet (illustrated in Figure 3) on which the first two of five columns, giving workmen's names and clock numbers, are already filled in. Each of the three maintenance foremen has his own special sheet. In the remaining three columns the foreman enters opposite each workman's name the data describing his major assignments for that day. These data include a title description of the job, for what department, and the accounting charge number. It is not possible or necessary to include the many minor adjustments or 5-minute repairs a workman may be called upon to do that day. The plant engineer needs only to know what important jobs are being scheduled or delayed. As a rule, urgent jobs are given precedence, and regular jobs are arranged in the most efficient order with secondary regard to the date the order was received.

Better Welding Grounds Stop Shock Hazards

A. S. DURKIE, Chief Electrician, and K. G. MILLINGTON, Safety Inspector, Graham-Paige Motors Corporation, Detroit

In July, 1944, a Graham-Paige welder on amphibian tanks received a severe electric shock. He had to be freed by fellow-workmen and taken to first aid. Fortunately, no permanently harmful effects resulted; but this, and other serious accidents at about the same time, led to a study and revision of the whole grounding plan throughout the welding department, where 143 d.c. arc welders were in operation. The investigation of the incident indicated that other welders had received shocks at various times, but they had not been as severe. No shocks have been reported since the alterations described here were made.

To begin with, the building was not well adapted to handling large amphibian tanks. The 11-ft. roof structure precluded the use of balconies for the location of the welding generators; and inadequate clearance made it necessary to use a chain hoist at each end of the tank, instead of a crane. The dangling chains from these hoists came in contact with the sides of the tanks. With the unsatisfactory grounding system in operation, the grounds were inadequate for the current used, and the chains were serving as partial grounds. Since the links did not make a good electrical contact, the resistance resulted in heating, which caused an undue number of burns.

The tanks were moved down the length of the building from fixture to fixture, turned by trunnions on their sides and upside down, where necessary for convenience in welding, during the fabrication process. The hull was entirely welded, requiring 143 welding machines, with generally six welders to each fixture. Before the change, these machines were located somewhat indiscriminately about the welding floor, with long stretches of

The method of placing welders in groups of twelve is shown at the left. At the right can be seen one of the terminal boxes, at a welding station, into which the welders' cables are plugged. The strip of floor plate, in the center, covers a trench carrying the cables that connect the welders and the terminal box

Dry gloves help minimize shock hazards. Six pairs can be dried simultaneously on this glove drier. Two 500-watt strip heaters provide the warm air that is forced into the gloves by a small blower

cable leading from the machine to the electrode holder. Theoretically they were located in fixed stations, but the result in practice was a scattering about the floor. If a welder still had work to do on the hull which had moved to a succeeding fixture, he would get an extension cable and continue using the same machine rather than move to a succeeding generator. Hence cables up to 200 feet in length were used.

Undesirable Results

This practice had three undesirable effects: (1) There was excessive wear on the cables; (2) the floor was covered with cable and could not be kept clean; and (3) the excessive length of cable required a build-up in voltage from about 70 volts in a 50-ft. cable to about 90 volts in a 200-ft. cable to overcome the greater resistance. This long cable increased shock hazards and the danger of tripping.

The welding machines are d.c. generators, with a full-load rating of 300 amp., driven by a.c. motors. Light welding work, however, only requires an amperage of 150 to 175. To secure the maximum flexibility, No. 1 cable is used from welder to electrode holder.

The old grounding scheme involved the use of metal strips about ¼ inch thick and 1½ inches wide, which were connected to a metal plate covering a pipe tunnel in the floor, a window sill, or any other convenient medium, or, with mobile machines, any ground connection the welder desired to use. The result was that the ground was not always sufficient to carry the load. There was, however, another factor involved. In summer, welders sweat profusely and wet gloves and clothing increased the shock hazard.

The plan to reduce the hazards covered three phases. First, grounds were laid out in a consistent plan and their capacity increased. Second, cable lengths were reduced. Third, driers were installed to dry the gloves worn by welders.

The first step was to anchor the welding machines to fixed locations. A welded steel framework was provided with stalls for twelve machines in two tiers of six each. These were placed between two fixtures, six welders to each fixture.

The next step was to carry cables in a tunnel from each machine bank to a terminal box welded to each fixture (in the old plan, the terminal box was located on the machine). The grounds consist of three strips of steel, ⅜x4 inches, running from the fixtures to the framework of the welder banks, and from there to a building upright. Each generator was, of course, grounded to the bank framework. Where grounds traversed trucking aisles, the ground strips were made ⅜x6 inches for minimum wear on the trucks. All connections in the ground circuit are welded joints. Since a strip ¼x4 inches will carry 210 amperes continuously with a 30-deg. temperature rise, it was considered that this grounding layout had sufficient capacity to eliminate all shock hazards.

Less Cable Needed

With the terminal boxes on the fixtures, the length of cable could be reduced. A 50-ft. cable will reach anywhere around the jig or fixture. With a short cable, the resistance is less and the chance of a shock is less than with the long cables previously used. Moreover, the shorter cable involves less dragging about and less wear. It was found that this saving was sufficient to pay for the change within a few months. There is less welding cable on the floor, and the floor can be cleaned more readily.

The final step in the solution was the use of a drier for gloves as soon as they become wet with sweat. Two pairs of leather gloves are furnished to each welder. While a welder is using one pair of gloves, the other pair is on the drier.

The driers are spaced around the welding floor at convenient locations for the welders' use. They are heated by electricity and are provided with a small blower to circulate the air through and around the gloves. Experience indicates that the gloves are thoroughly dried in about 20 minutes. The approximate cost of these driers is $16 each.

This installation has now been in operation for some time and during this time, no difficulty has been encountered—no shocks have resulted and no burns have been experienced from dangling hoist chains serving as partial grounds. Some 65 feet less of cable per welder is in use at any one time; and the discarding of cables through wear has been reduced by about 1000 feet per month.

Third-Shift Repairs Save Machine Downtime

W. L. GEORGEN, Plant Engineer, International Harvester Company, Indianapolis

Effective plant maintenance lowers unit product cost

FOR MAXIMUM PRODUCTION, make repairs on production machinery, whenever possible, only when that machinery is not being operated! This is the rule that has guided the activities of the maintenance department in the foundry section of the International Harvester motor manufacturing plant at Indianapolis for the past several years.

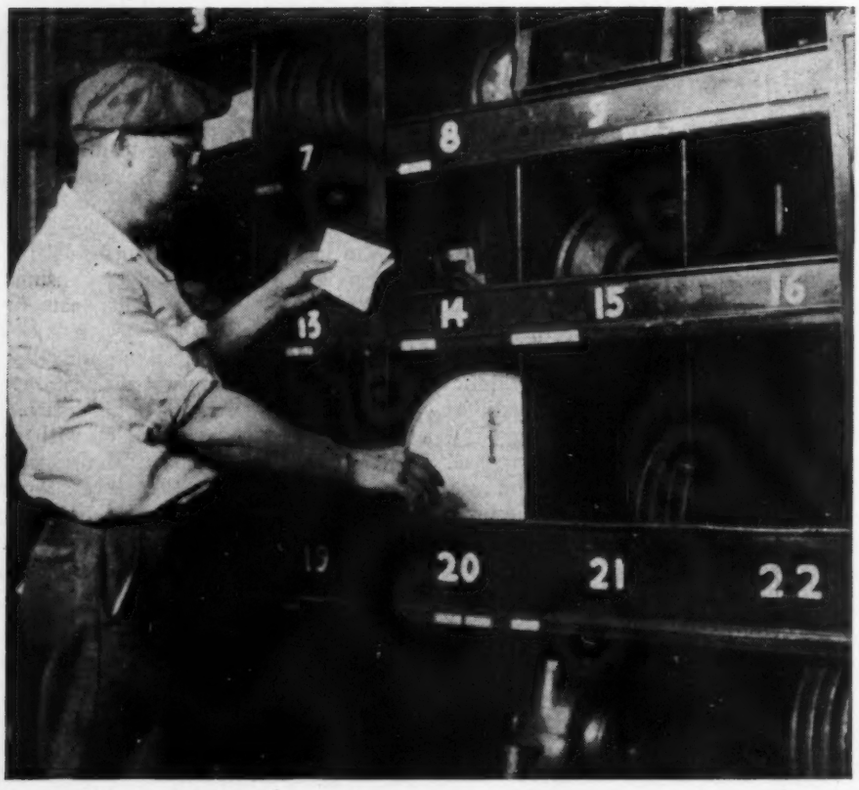
The foundry of this plant operates on the first two of three shifts each day. Most of the foundry operations are highly mechanized, and failure of any one part of its "production-line" machinery will seriously cripple the plant and slow down production in the machine shop, which is largely dependent on the foundry output.

The idea, therefore, is to keep the foundry machinery as free as possible from interruptions caused by breakdowns or downtime for repairs. Despite careful inspection and lubrication practices, however, machinery in this type of service often develops sudden symptoms of trouble that presage imminent breakdown. When this happens every attempt is made to supply ingenious crutches that will enable the machine to hobble along until the close of the production day.

If a bearing is running hot, for instance, a maintenance man is stationed there with an oil can and an air hose for cooling, to keep the bearing going until the end of the work day. Or when a machine part breaks, some quick, temporary makeshift repair is rigged up to make it possible to carry on for the rest of the day. While such practices might not make the maintenance expense sheet look very good, in the over-all effect they are a whole lot cheaper than machine downtime.

But it was found that there was no value in postponing repair during the operating time of one day only to require some downtime, possibly for several hours, at the opening shift the next day to complete the repair.

A simple provision has removed this difficulty. The maintenance shift on whose time the trouble originates is responsible for the preparation of the work. Now, when a breakdown repair order is postponed for the third shift, the job is analyzed for its requirements by the current shift. All replacement parts are provided, either by withdrawal from stock or by emergency purchase. In one instance a large sprocket, impossible to obtain on short notice, was made from steel plate in the shop.



Small parts and equipment needed for machine repairs involving downtime, and therefore postponed to the third shift, are placed in special bins by maintenance men of first or second shifts

Prepare Special Tools

In addition to seeing that all needed machine parts are available, the current maintenance shift also must get ready all special tools and equipment required for the repair. A row of steel bins has been located adjacent to the maintenance shop office to hold all small parts and tools for each job. Each work order bears the bin number where these parts have been segregated. Where large parts or equipment are involved, they are taken right to the job location.

In short, everything is prepared so that when the third shift arrives it can proceed immediately with the actual repair. As a result, all breakdown repair jobs are done not only more quickly, but also more efficiently, and it rarely happens that even the toughest jobs are not completed in time to permit resumption of normal operations at the beginning of the first shift the next morning.

The Cost of Maintenance in Seve

Compiled from data on profits and operations contained in a survey of the

Industry [1]	No. of Companies		Total Net Sales, Dollars [2] (in Thousands)	
	1942	1943	1942	1943
Agricultural machinery and tractors	10	10	978,073	1,300,753
Aircraft and aircraft equipment	31	29	4,434,979	7,018,611
Apparel and related finished products (shirts, ties, hats, underwear)	17	16	173,005	180,440
Automobile parts and accessories	82	79	2,429,860	3,721,694
Automobiles	10	10	3,584,428	5,870,838
Biscuits and crackers	6	6	268,297	315,747
Bolts, nuts, and rivets	6	6	75,844	101,484
Bread and cake	7	8	258,715	329,609
Breweries	27	27	107,228[6]	140,815[6]
Building equipment (stoves, furnaces, pipefittings, locks)	22	23	524,209	645,929
Building materials other than clay products and cement (glass, roofing, metal sash, insulation)	18	18	493,285	540,231
Cement	8	8	99,691	73,981
Chemicals	40	41	2,046,035	2,519,106
Chewing gum, candy, and confectionery	11	10	200,493	201,919[10]
Cigarettes	7	6	1,339,184[11]	1,553,032[11]
Cigars	8	8	90,956	99,594
Clay products (brick, tile, refractories)	13	13	89,390	81,897
Clocks and watches	5	5	67,974	75,259
Commercial cars and trucks	13	12	848,021	597,824
Construction, mining, and related machinery (power shovels, loaders, graders)	13	13	241,011	340,121
Dairy products	8	9	1,163,366	1,342,317
Drugs and medicines	15	15	459,239	583,185
Electrical household appliances and related products	17	18	120,210	200,056
Electrical supplies and equipment (switches, starters, wiring devices, instruments)	33	33	1,956,381	2,787,000
Engines and turbines	8	9	261,443	440,003
Fertilizers	5	5	104,552	123,520
Firearms	3	3	196,202	183,170
Floor coverings and miscellaneous textiles (lineoleum, rugs, automotive fabrics)	15	14	334,172	366,129
Food canning and preserving	11	10	301,386	331,360
General industrial machinery (pumps, air compressors, meters, valves, air tools)	42	40	880,212	1,207,338
Grain mill products (flour, cereals)	9	10	381,411	633,556
Grocery specialties and miscellaneous food products	14	14	774,945	866,430
Hosiery	12	12	92,520	97,816
Household utensils	6	6	28,242	42,183
Iron and steel foundry products	9	9	87,371	86,964
Leather tanning	5	5	53,243	52,064
Lumber and lumber products (plywood, sash, boxes, furniture)	18	17	236,140	243,230
Manufacturing industries — miscellaneous (optical goods, ice, dental equipment, mattresses)	30	29	310,839	364,851
Meat packing and allied products	13	14	4,201,882	4,608,564

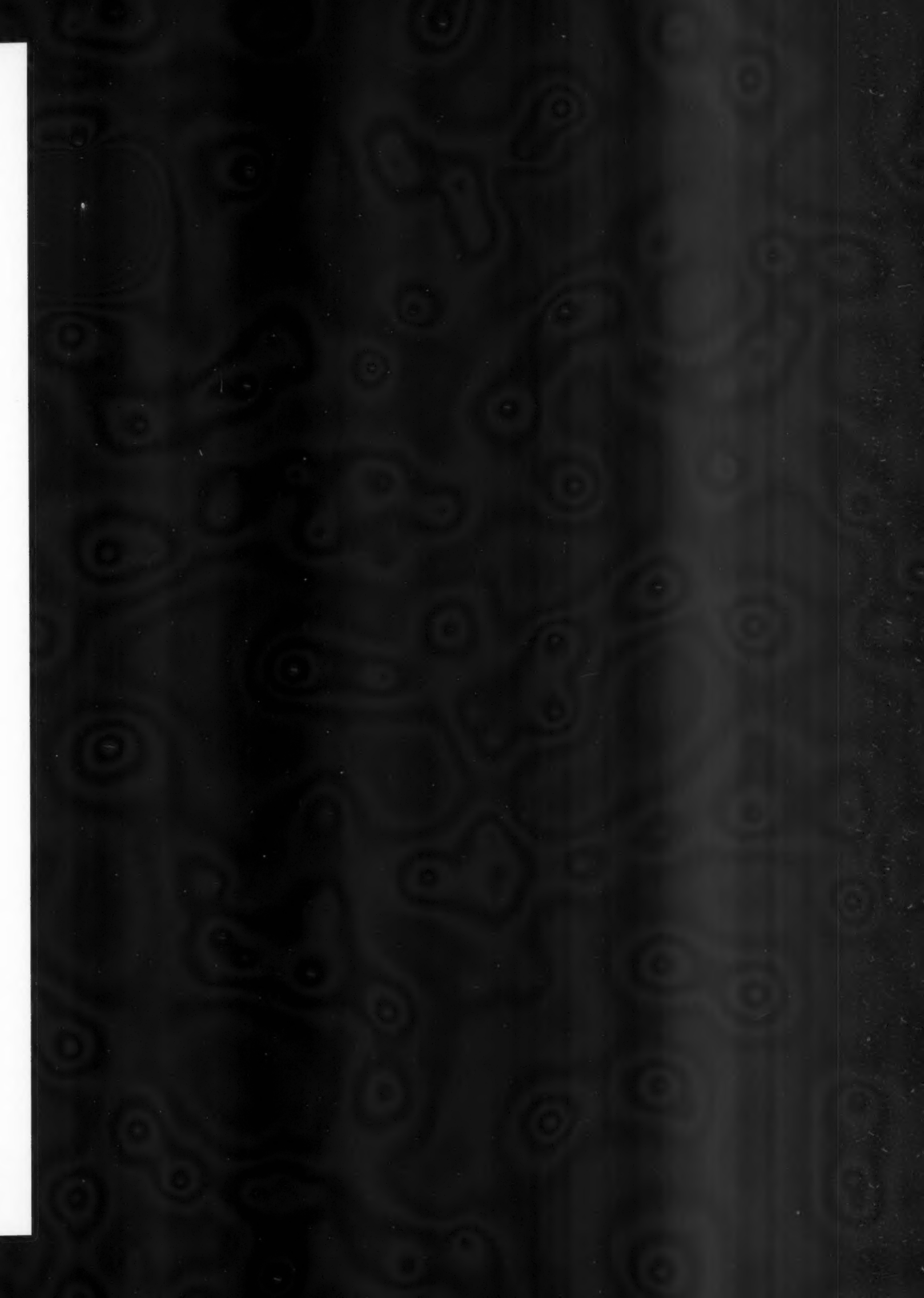
Seventy-Five Industries

rvey of the Securities and Exchange Commission

es, Dollars [2] ands)	Total Maintenance and Repair Costs, Dollars [3] (in Thousands)		Maintenance and Repair Costs Percent of Net Sales					
			1942			1943		
1943	1942	1943	Individual Company		Industry Average	Individual Company		Industry Average
			High	Low		High	Low	
1,300,753	31,396	40,172	4.1	1.2	3.2	4.6	1.0	3.1
7,018,611	62,246[4]	101,433[5]	4.4	0.5	1.4	4.2	0.4	1.4
180,440	1,775	1,960	1.9	0.1	1.0	2.8	0.2	1.1
3,721,694	76,616	106,969	9.5	0.1	3.2	10.6	0.4	2.9
5,870,838	247,563	367,807	6.5	1.1	6.9	5.0	1.3	6.3
315,747	5,425	6,088	2.3	1.1	2.0	2.1	0.8	1.9
101,484	2,587	3,514	5.8	0.1	3.4	6.0	3.8	3.5
329,609	6,908	8,813	4.0	1.8	2.7	4.5	1.7	2.7
140,815[6]	2,819	3,522	6.2	1.1	2.6	7.5	0[7]	2.5
645,929	14,092	18,330	5.7	0.3	2.7	5.7	0.2	2.8
540,231	18,783	21,430	9.5	0.5	3.8	11.2	0.6	4.0
73,981	6,077	5,018	14.8	3.0	6.1	13.7	2.9	6.8
2,519,106	90,909[8]	110,514[9]	10.5	0.1	4.4	11.2	0.1	4.4
201,919[10]	1,779	2,053	2.2	0.2	0.9	2.6	0.6	1.0
1,553,032[11]	2,741	3,116	0.6	0[12]	0.2	0.5	0[12]	0.2
99,594	738	803	1.8	0.2	0.8	2.1	0.5	0.8
81,897	6,085	6,440	10.1	2.5	6.8	12.6	0.7	7.9
75,259	1,414	2,055	3.1	0.9	2.1	5.0	1.0	2.7
597,824	10,300	6,107	2.7	0.1	1.2	4.3	0.1	1.0
340,121	6,541	8,528	6.7	0.5	2.7	6.8	0.6	2.5
1,342,317	23,851	27,234	2.6	0.8	2.1	2.6	0.8	2.0
583,185	4,812	6,689	3.2	0.5	1.0	2.7	0.5	1.1
200,056	3,248	5,102[13]	6.1	0.7	2.7	5.1	0.5	2.6
2,787,000	41,107	54,332	6.7	0.3	2.1	5.1	0.3	1.9
440,003	5,165	8,447	3.8	1.0	2.0	3.4	1.0	1.9
123,520	5,254	6,604	10.4	2.4	5.0	10.9	2.3	5.3
183,170	3,828	4,006	2.1	0.5	2.0	2.2	0.1	2.2
366,129	10,995	13,110	4.8	0.5	3.3	5.5	0.7	3.6
331,360	6,254	7,274	16.3	1.3	2.1	11.8	0.9	2.2
1,207,338	21,965	24,628	12.1	0.1	2.5	9.8	0.3	2.0
633,556	2,868	4,185	1.2	0.2	0.8	1.2	0.2	0.7
866,430	9,638	12,724	3.1	0[14]	1.3	3.3	0[15]	1.5
97,816	1,519	1,657	2.8	0.9	1.6	2.9	0.6	1.7
42,183	891	1,975	4.4	0.4	3.2	7.8	0.7	4.7
86,964	5,292	5,774	8.5[16]	2.8	6.1	8.8[16]	2.4	6.6
52,064	850	910	2.0	0.8	1.6	2.7	0.5	1.7
243,230	4,058	4,184	2.8	0.2	1.7	2.8	0.2	1.7
364,851	7,649	9,275	4.5	0.4	2.5	4.3	0.1	2.5
4,608,564	36,620	41,793	2.2	0.2	0.9	1.1	0.2	0.9

ht, 1945, McGraw-Hill Publishing Co., Inc. — All Rights Reserved

Footnotes on reverse side



The Cost of Maintenance in Seventy-Five Industries

Industry [1]	No. of Companies		Tot
	1942	1943	1
Metal and glass containers	9	9	65
Metal-working machinery (machine tools, saws, drills, presses)	29	29	66
Miscellaneous iron and steel products (pipe, forgings, steel springs)	17	16	39
Non-alcoholic beverages	15	14	22
Non-ferrous metals, including smelting and refining	22	23	1,69
Non-ferrous metal products (copper wire, alloys, brass, bronze, copper shapes)	17	17	55
Office machinery and equipment	10	10	39
Oil refining	37	37	5,33
Paints and varnishes	9	9	14
Paper and allied products	47	46	98
Pens and pencils	3	3	2
Photographic equipment	4	4	24
Pig iron	4	4	8
Printing and publishing, other than newspapers and periodicals (books, catalogs, calendars, commercial printing)	14	14	9
Newspapers and periodicals	9	8	12
Printing trades machinery	6	6	5
Raw cane sugar	15	15	11
Radio and radio equipment	17	19	46
Railroad equipment (locomotives, cars, brakes, castings, forgings)	20	20	1,51
Rayon yarn	6	6	22
Rolling mills without steel making facilities	5	5	7
Safety razors	3	3	3
Screw machine products	3	3	4
Shipbuilding	8	7	65
Shoes	14	13	41
Snuff and miscellaneous tobacco products	4	4	3
Special industry machinery (food, shoe, laundry, rubber-working)	20	20	25
Steel producers with blast furnace facilities	15	15	5,40
Steel producers without blast furnace facilities	13	13	36
Sugar refining, beet	6	6	11
Sugar refining, cane	6	6	17
Textile fabrics	12	14	61
Tires and other rubber products	16	16	1,44
Toilet preparations and soap	10	10	45
Toys and sporting goods	4	4	2
Vegetable oils	5	5	23

1. The survey includes only those companies which have securities listed and registered on national securities exchanges under the Securities Exchange Act of 1934, or which are required to file annual reports as registrants under the Securities Act of 1933. Only manufacturing companies are considered here.

2. Net sales may include or exclude excise, sales and/or other taxes, depending upon the general treatment given to these items by the registrants in the industry. Operating revenue may or may not be included, generally depending upon the treatment of this item by the registrant.

3. Maintenance and repairs are the amounts reported by the registrant as its charges for these items to profit and loss, whether charged to Costs or Other Than as Costs.

4. Total for 30 registrants.

5. Total for 28 registrants.

6. Net sales adjusted to exclude federal and state excise taxes whenever amounts have been reported.

7. Reasons for this figure were not given. The next lowest figure was 1.1 percent.

8. Total for 39 r

9. Total for 40 r

10. Data for one these totals.

11. Revenue sta included in sales.

12. Reasons for The next lowest fig

13. Represents t

14. Reasons for The next lowest fig

dustries *(Continued)*

npanies	Total Net Sales, Dollars [2] (in Thousands)		Total Maintenance and Repair Costs, Dollars [3] (in Thousands)		Maintenance and Repair Costs Percent of Net Sales					
					1942			1943		
1943	1942	1943	1942	1943	Individual Company		Industry Average	Individual Company		Industry Average
					High	Low		High	Low	
9	653,160	676,523	23,557	26,021	10.9	1.5	3.6	6.5	1.7	3.8
29	662,238	765,848	14,414	16,491	6.5	0.1	2.2	7.0	0.2	2.2
16	392,485	673,572	8,043	13,521	5.1	0.3	2.0	5.2	0.2	2.0
14	227,666	261,821	1,969	1,888	3.3	0.3	0.9	2.7	0.2	0.7
23	1,696,941	1,882,023	88,191[17]	105,243[18]	10.4	0.3	5.2	12.4	0.4	5.6
17	559,631	664,392	21,802	24,729	6.2	0.2	3.9	6.7	0[19]	3.7
10	394,293	486,591	12,993	15,419	24.8[20]	1.1	3.3	24.2[20]	1.2	3.2
37	5,333,331[21]	6,436,113[21]	207,852	250,431	6.2	0.9	3.9	7.2	1.1	3.9
9	142,742	163,738	1,540	1,988	1.4	0.4	1.1	1.6	0.3	1.2
46	981,779	1,056,229	45,970	47,198	9.6	0.2	4.7	9.2	0.2	4.5
3	23,292	33,536	158	213	1.0	0.4	0.7	0.7	0.5	0.6
4	241,935	297,890	8,377	10,282	15.2	1.0	3.5	9.2	1.8	3.5
4	83,726	89,419	5,618	6,846	9.5	4.9	6.7	9.9	5.9	7.7
14	99,195	118,107	1,728	1,984	3.4	0.2	1.8	3.0	0.2	1.7
8	125,865	146,096	1,727	1,532	4.2	0.1	1.4	1.7	0.1	1.0
6	55,475	94,652	1,462	2,099	3.3	1.5	2.6	3.2	1.5	2.2
15	114,636	95,672	5,377	5,851	8.7	2.5	4.7	17.6	2.6	6.1
19	461,221	870,944	10,193[22]	16,883[23]	5.8	0.3	2.2	7.0	0.1	1.9
20	1,516,821	2,012,580	71,521	87,201	14.8	0.7	4.7	14.6	1.1	4.3
6	227,065	259,238	9,164	11,586	8.1	1.1	4.0	7.0	1.9	4.5
5	78,840	106,100	1,886	2,523	3.9	0.7	2.4	3.5	0.6	2.4
3	37,926	43,173	1,147	1,570	4.9	2.1	3.0	4.5	3.2	3.6
3	4,958	7,294	139	157	4.9	1.4	2.8	3.7	1.0	2.2
7	653,262	747,028	9,854[24]	12,610	4.0	0.5	1.5	3.5	0.7	1.7
13	410,222	412,707	4,852	4,627	2.0	0.3	1.2	2.0	0.4	1.1
4	39,274	40,051	348	378	1.2	0.2	0.9	1.2	0.2	0.9
20	256,099	350,922	3,921	4,976	5.8	0.1	1.5	5.4	0[25]	1.4
15	5,403,508	6,105,940	422,297	470,216	10.3	5.4	7.8	10.3	5.6	7.7
13	366,622	408,019	17,752	20,566	9.4	1.1	4.8	12.9	1.3	5.0
6	118,210	127,165	4,950	5,693	4.8	2.9	4.2	5.9	2.3	4.5
6	171,772	206,581	3,185	3,450	6.6	0.9	1.9	8.4	1.6	1.7
14	617,134	685,368	12,445	12,347[26]	4.3	0.4	2.0	3.4	0.4	1.8
16	1,446,161[27]	2,284,245[27]	33,540	49,801	3.7	0.7	2.3	4.1	1.1	2.2
10	458,222	518,292	7,183	7,262	2.0	0.1	1.6	1.8	0.1	1.4
4	28,486	30,337	742	1,130	3.6	1.8	2.6	5.3	1.9	3.7
5	234,773	289,231	1,915	2,670	1.6	0.7	0.8	1.8	0.7	0.9

8. Total for 39 registrants.

9. Total for 40 registrants.

10. Data for one company are not included in these totals.

11. Revenue stamp taxes and/or duties are included in sales.

12. Reasons for this figure were not given. The next lowest figure was 0.2 percent.

13. Represents the total for 17 registrants.

14. Reasons for this figure were not given. The next lowest figure was 0.3 percent.

15. Reasons for this figure were not given. The next lowest figure was 0.4 percent.

16. Includes repairs, replacements, and additions to patterns and flasks.

17. Total for 21 registrants.

18. Total for 22 registrants.

19. Reasons for this figure were not given. The next lowest figure was 0.4 percent.

20. The predominant portion of this registrant's income is derived from rentals. The next highest figures are 7.4 percent in 1942 and 6.2 percent in 1943.

21. State and federal excise taxes on gasoline and oil are excluded from net sales.

22. Total for 16 registrants.

23. Total for 18 registrants.

24. Total for seven registrants.

25. Reasons for this figure were not given. The next lowest figure was 0.4 percent.

26. Total for 13 registrants.

27. Federal excise taxes, when reported, have been excluded from net sales.

Saving With Rechargeable Flashlight Batteries

M. A. RANEY, Electrical Maintenance Engineer, Servel, Inc., Evansville, Ind.

To KEEP maintenance operating at peak efficiency, the "canny buyer" has had to keep a weather eye out for substitutes. Many of the substitutions were strictly "Victory Models" and have been abandoned as soon as practical. Others have been proved so successful that they will be continued long after the shortage is eliminated.

Servel has had such an experience with flashlight batteries.

Shortly after the war began it became nearly impossible to locate flashlight batteries for use by plant inspectors on P-47 Thunderbolt wings. A flashlight is an important piece of equipment to an inspector, enabling him thoroughly to check each nook and cranny of a wing. Without a flashlight and mirror, inspection would be extremely slipshod.

When dry cell batteries became unobtainable, Servel purchasing agents looked for another battery source and found it in the "wet cell' rechargeable battery. One rechargeable cell, at a cost of approximately $1.90, will take the place of two dry cells and has 200 lives, by virtue of its ability to be recharged that number of times.

These 200 lives last an average of two years, both by guarantee and by actual record. Two years of regular dry cells consists of about 200 batteries per flashlight. The cost of 200 batteries at 5 cents each would amount to $10. Against an initial outlay of $1.90 for the other, the original cost of dry cells was much higher, and even after adding cost of upkeep, the total over-all difference in the price was still in favor of the rechargeable batteries.

Keeper of the storage cells and chief recharger is a member of the plant's inspection department. It is her job to handle all incoming and outgoing flashlight batteries. Here she checks a cell that has just been recharged to see if the charge is up to requirement

Battery life is renewed in rechargers located in the inspection department. Twelve of these rechargers are operated by a girl who divides her time between this job and a blueprint checking operation. Inspectors are instructed to return each battery at the end of the day's work before it becomes "dead," in order to make recharging easier. With the hard use batteries receive, their life is oftentimes not much longer than a day and a half.

As they are returned, they are placed on the rack for recharging and the inspector is given a new wet cell. When the cell is first issued, each inspector signs a card stating that he is responsible for a battery and flashlight. If anything other than normal wear happens to the battery, the inspector must stand the cost.

According to records kept for the first year that rechargeable batteries were in use, the actual saving was $524.45. At the time, 264 flashlights were in service. Each flashlight used two dry cells once per week on the average (some used one set per day). The cost of each cell was 6.5 cents. The total dry cell cost per year (on a 50-week year) was $1716.

Storage Battery Costs

On the storage battery side of the ledger, it was discovered that a total of 444 cells had been purchased—264 for immediate use, 150 on charge, and 30 in reserve. At a cost of $1.90 per cell, $843.60 was spent. In addition to this cost, 14 twelve-station chargers at $19 apiece were purchased, for a total cost of $266 plus $60 installation costs. Two special testers at $6.75 cost $13.50. The total charge was $1183.10 for two years, since each cell was guaranteed for that length of time. That meant a yearly cost of $591.55.

To this initial cost of the storage cell was added a labor cost of handling the cells per year, $600. The total cost per year amounted to $1191.55. Subtracted from the figure of the cost of dry cells per year, this meant a gross saving of $524.45.

Now Cleans Floors Faster

VICTOR C. HOFFMAN, General Foreman and Superintendent, Minneapolis-Moline Implement Company, Minneapolis

Effective plant maintenance lowers unit product cost

STUDY OF AVAILABLE METHODS of removing thick deposits of dirt from factory and machine shop floors subject to heavy-duty traffic has enabled Minneapolis-Moline Implement Company to solve its floor maintenance problems in a satisfactory manner. The results obtained under the new procedure that was adopted, compared with the methods of floor cleaning that were previously used, and carefully checked over a 2-year period, reveal several important advantages.

To summarize briefly, these advantages are:

1. All soilage, including truck-packed dirt, grease, and metal cuttings, can be removed from floors in one operation. Cleaning is done with an industrial floor machine equipped with a 16-in. drum-type steel wire brush.

2. One maintenance man now cleans ten times more floor space per hour than by previous manual cleaning methods.

3. Floors can be cleaned without interference with plant operations. No sweep-up is required.

4. Floors are left dry, ready for immediate use. No liquids or chemicals are employed.

5. The action of the revolving drum-type brush tends to smooth and level floor surfaces, and leaves a smooth, hard surface without digging or gouging.

6. Soilage is discharged into a built-in hopper. Dust is drawn into a canvas bag by vacuum.

Because the soilage conditions in this plant are typical of those in many others, its experience in solving floor-cleaning problems may be helpful.

The maintenance officials were dissatisfied with the methods of floor cleaning that had been tried for years with indifferent success. The layer of grime was just too tough.

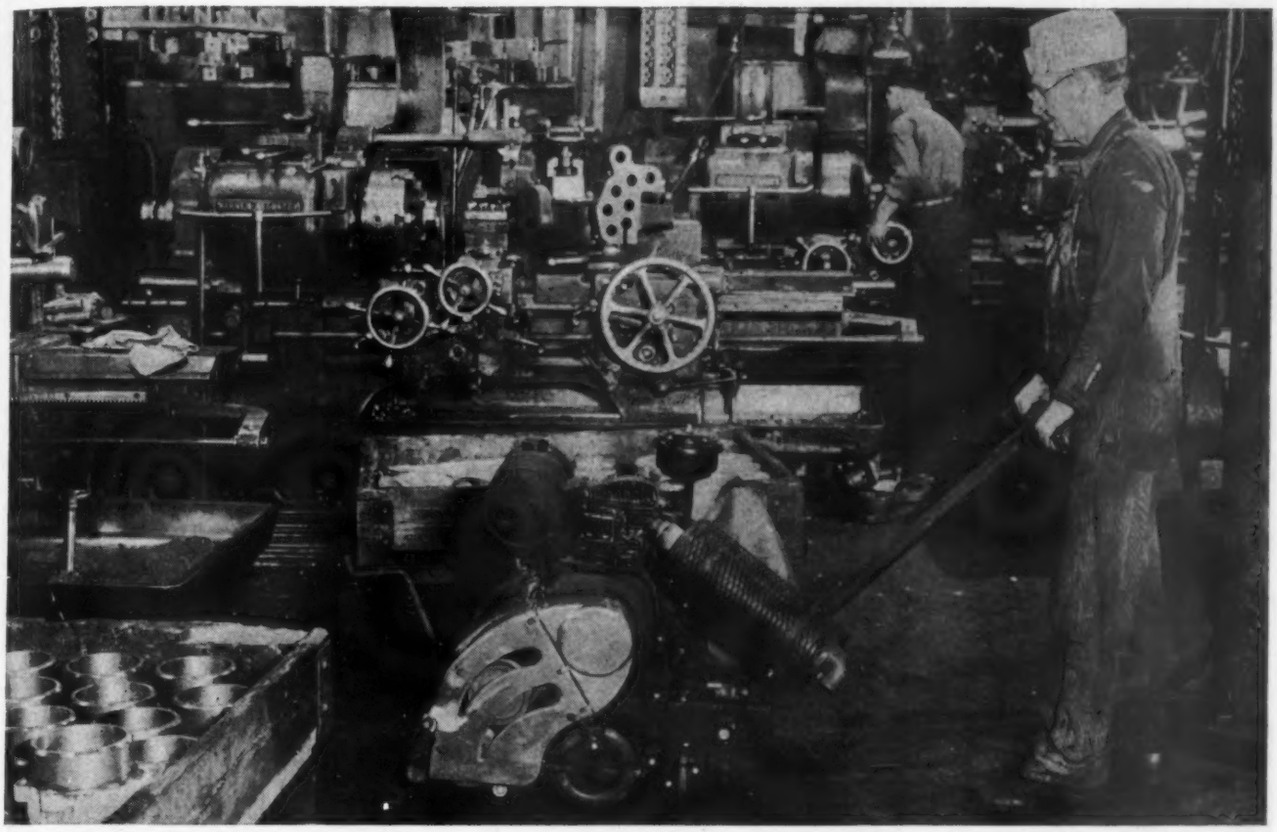
Grease and oil spillage from trucks, motors, and machinery inevitably mixes with dust, dirt, and grit. The result is a thick, tough, rubbery blanket in which metal cuttings and chips from machine operations become firmly imbedded. Under the weight of heavy trucks loaded with automotive transmissions and other heavy equipment, this blanket of grime builds up step by step. It produces an irregular, bumpy surface that causes damage to trucks and their loads, results in waste of power in trucking, and is quite frequently responsible for skids and accidents.

Coatings of dirt on factory floors are cut down by a revolving steel wire brush. The heavy material removed is deposited in an in-built hopper, while light particles are drawn by vacuum into the canvas bag. The machine is driven by a gasoline engine

Hard to Clean

To clean floors like this is a major job. The hard-packed mass of dirt clings firmly to wood blocks or concrete. It resists solvents, soap and water, scrubbing. In fact, it was found that the only way to loosen such soilage effectively was by hand-scraping, which is laborious and costly.

This method was used for a number of years, although its shortcomings were obvious. Among other things, cleaning with hand scrapers often meant shutting down a department or floor area while the job was under way. This was necesssary because the aisles were blocked by crews of laborers and their equipment—scrapers, hoes, shovels, and wheelbarrows. Trucks and other moving equipment had to be rerouted around the area being cleaned, thus retarding production flow and causing safety hazards by overloading aisles.



Floor cleaning by machine is not limited to open spaces. It can be done also in crowded areas

It was also found that hand scraping caused gouging of floors, making an uneven, bumpy surface, as well as shortening floor life through the unavoidable chipping and cracking of wood blocks and concrete. In addition, the scraping operation required large crews, even for small areas, and it was slow, hard, work. Cleaning costs per foot of floor space were high.

After a lengthy study of representative mechanical cleaning methods based on the conditions in this plant, it was decided to conduct tests with a floor-cleaning machine employing a revolving steel wire brush.

Prior to the test some misgivings were voiced that the weight of the machine (450 pounds) might make it difficult to operate, particularly in cleaning up close to walls and around machines. Also, that the revolving steel wire brush would become clogged with the sticky soilage.

As soon as the machine was put in operation, however, it was found that its weight was more than offset by the self-propelling motion of the revolving brush, so that little effort was needed to control it. There was no clogging of the revolving brush.

Pick-up of both light and heavy soilage was found to be effective, eliminating any need for sweeping up after the machine, except under rare circumstances. This observation was confirmed by cleaning tests in various parts of the plant under widely different soilage conditions.

In one of the areas selected for a cleaning test, soilage ¼ inch deep had been packed and pounded into a pitch-coated wood block floor by the long-continued passage of heavy trucks and other traffic.

Operated by one of the plant's maintenance men, the floor machine plowed through the thick coating down to the clean floor at the rate of 1000 square feet in 56 minutes. No sweeping up was necessary.

A Further Test

Another test involved removal of an asphalt coating that had been laid over concrete some five years before. This coating was about half an inch thick, and hard, lumpy and tenacious.

Using a special drum-mounted cutting tool, the floor machine completely removed the tough asphalt at the rate of about 100 pounds in five minutes. The concrete underneath was left smooth, clean, and ready for traffic.

Among the many other tests that were conducted was a cleaning job that formerly required the use of air hammers. This area was around paint spraying and draining booths where a thick, tough deposit of paint had built up over the years. It was heavy and hard. The maintenance department had found that this deposit could be removed with air hammers, but this method was unsatisfactory because it was difficult or impossible to avoid some damage to the floor underneath the paint accumulation.

When the floor cleaning machine was equipped with the special tool mentioned previously, the entire deposit was smoothly removed in a few minutes. By previous methods this job might have required 8 hours.

Today foremen see that every shop floor is cleaned every two weeks.

Comparison with results previously obtained shows that one man, operating a floor machine, now accomplishes as much, hour for hour, as ten men did before by manual scraping. Any area can now be cleaned with only a fraction of the crew formerly required, and without interfering with plant operations. Further, machine cleaning has been found to produce a surface that is much more smooth and level than before.

The bimonthly cleaning schedule has been found adequate. This makes it possible to clean aisles, roadways, traffic lanes, and around machines often enough to prevent accumulation of excessive soilage.

Although the insulation resistance of machine windings is not a measure of dielectric strength, it may be used to show whether machine is in suitable condition for operation or application of tests

How to Make Insulation Resistance Measurements

GRAHAM LEE MOSES, Manager, Development Insulation Section, Transportation and Generator Division, Westinghouse Electric Corporation, East Pittsburgh

INSULATION RESISTANCE of electrical equipment in service, as measured with commercial instruments, is as much a function of moisture and dirt as it is of the type of insulation, its age or condition. While the insulation resistance of machine windings is not a measure of the dielectric strength, it may be used as an indication as to whether the machine is in suitable condition for operation or the application of dielectric or other tests.

The insulation resistance of a winding is usually defined as the resistance offered by the insulation to an impressed d.c. voltage that produces a leakage of current through the solid insulation and over its creepage surfaces. There are always two leakage paths, one through the body of the insulation, and the other over its surface. Either or both paths may be complex in nature, and usually are.

Insulation resistance is subject to wide variation with temperature, humidity and moisture content, age, and cleanliness of the winding. It will vary with the value of the applied test voltage and the time of application of this voltage.

Many of these apparent inconsistencies of insulation resistance readings can be explained if consideration is given to these factors. It is therefore necessary, where successive or periodic readings are to be correlated, to test

at a definite time and under definite conditions.

1. Effect of time of voltage application. The magnitude of the insulation resistance of windings will increase with the time of application of the d.c. test potential. The increase usually will be rapid at first, with readings gradually approaching a stable value as time elapses, as Figure 1 shows. Values obtained on 30 seconds' application may be as low as 10 percent of the final values. This variation is caused by the electrification or dielectric absorption effect in the insulation and is a function of the class and condition of the insulation and the voltage rating of the machine.

The insulation resistance of a clean and dry winding in good condition may continue to increase for hours with constant test voltage continuously applied. However, an approximately steady value will be reached in from 10 to 15 minutes. In a wet or dirty winding the steady value usually will be reached in less than 5 minutes.

Insulation resistance readings taken for purposes of correlation ought to be made following a definite time of test voltage application. For purposes of standardization, 60 seconds' application of voltage is recommended where single readings are to be made.

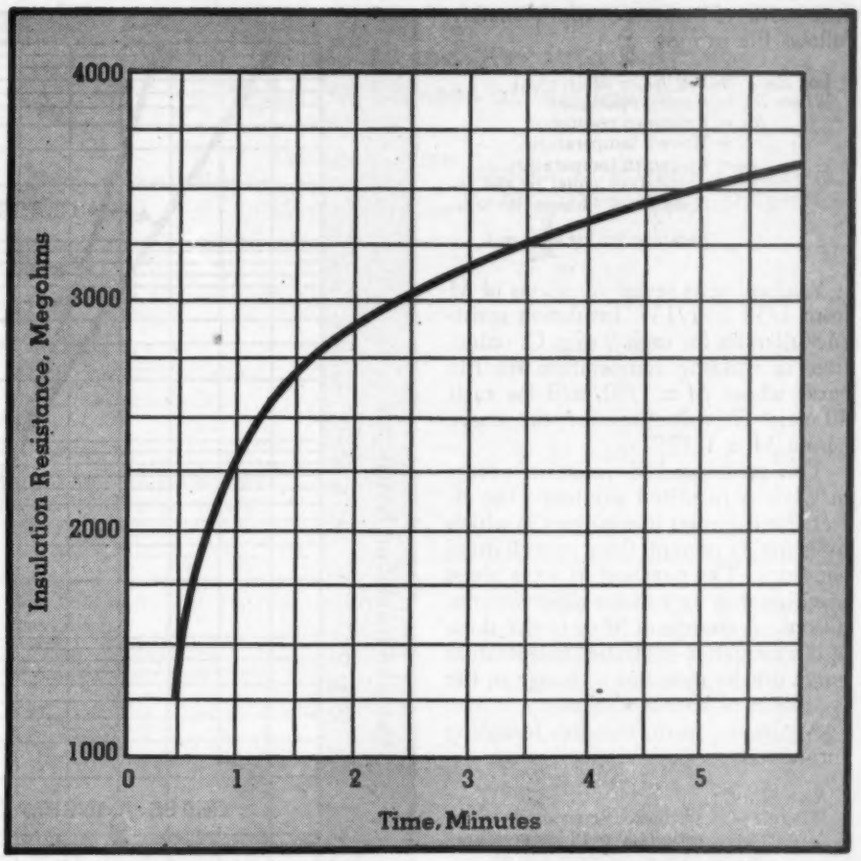


Figure 1. Effect of time of voltage application on the insulation resistance of railway motor armatures. Tests made at 500 volts d.c.

2. Effect of test voltage magnitude. Routine insulation resistance tests usually are made at d.c. voltages from 500 to 5000 volts. Insulation resistance decreases somewhat with an increase in applied voltage. However, for a variation of 2 or 3 to 1 in the usual test voltage range there is no appreciable effect on the insulation resistance of machines in good condition.

Marked variations in insulation resistance for different values of voltage usually are owing to the effects of moisture. For purposes of test correlation, it is recommended that the same voltage be used for each test in a series.

3. Effect of existing charge on winding. Values of winding insulation resistance are markedly affected by residual charges retained in a winding. For this reason, discharge the windings of large or high-voltage machines for at least 10 minutes preceding each test, by connecting winding to frame.

4. Effect of temperature. The insulation resistance in megohms varies inversely with the temperature at a rate depending upon the type of insulation, the degree of moisture present, and the condition of the surface. See Figures 2 and 3. Experiments indicate that the variation of insulation resist-

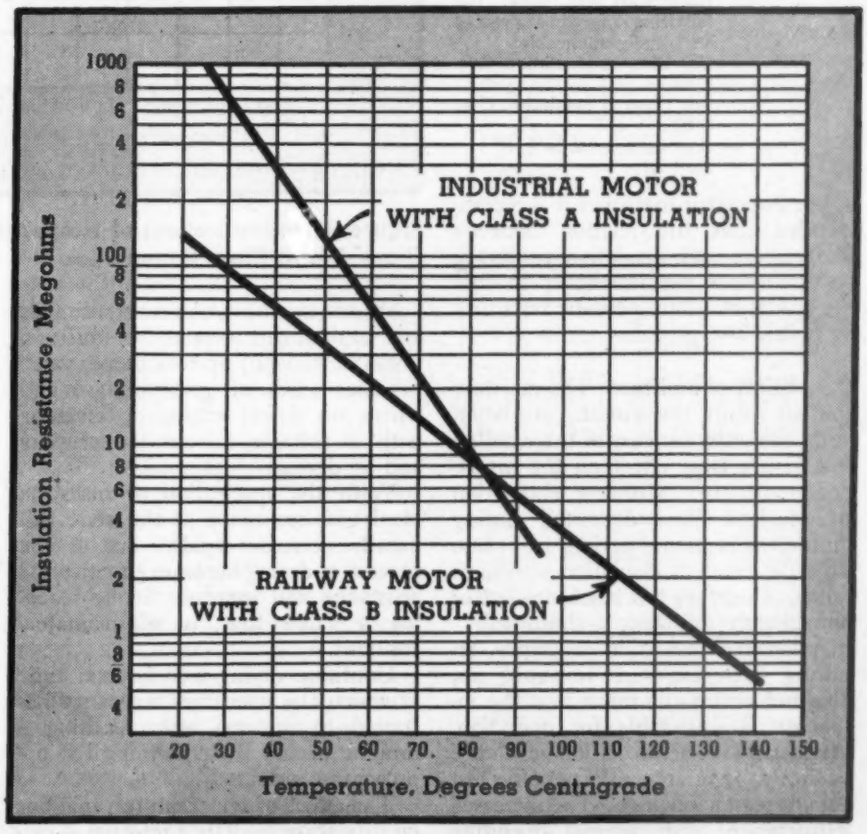


Figure 2. These curves show the effect of temperature on the insulation resistance of typical industrial and railway motors

ance with temperature approximately follows the expression:

$\text{Log } R_{t2} = \text{Log } R_{t1} - M\,(t_2 - t_1)$

Where R_{t2} = Known resistance
R_{t1} = Unknown resistance
t_1 = Known temperature
t_2 = Unknown temperature
M = A constant equal to the reciprocal of change in temperature for $\log \frac{R_{t2}}{R_{t1}} = 1$

Practical tests reveal variations of M from 1/30 to 1/135. Insulation resistance doubles for each 9 deg. C. reduction in winding temperature for the curve whose $M = 1/30$, and for each 40 deg. C. reduction for the curve whose $M = 1/135$.

The most marked variation occurs in Class A insulated windings; the effect also is greater in windings in which moisture is present than in well-dried windings. The constant M for a given machine may vary under different conditions. A change in M or in the slope of the insulation resistance temperature curve usually indicates a change in the condition of the insulation.

A simple form of the foregoing formula is:

$R_{t2} = R_{t1} C^n$

Where R_{t2} = Insulation resistance to be estimated at $t2$ temperature
R_{t1} = Insulation resistance at known temperature $t1$
C = Constant. For the insulation of low-voltage apparatus (2500 volts and below), the following approximate values are usually applicable:
For Class A insulation $C = 0.44$
For Class B insulation $C = 0.63$
n = Exponent equal to 1/10 $(t_1 - t_2)$

For important machines it is recommended that the relation between temperature and insulation resistance be established experimentally so that the results of future periodic tests may be readily interpreted.

5. Effect of moisture. The moisture content within the winding insulation or on the outer surfaces of the winding will have a large effect on the insulation resistance. Moisture absorption and surface films deposited during shutdowns in humid periods will cause large decreases in insulation resistance values. Therefore test machines hot or immediately following a shutdown.

A lowered insulation resistance, resulting from exposure to moist air, does not necessarily mean that the insulation is unsuitable for operation, particularly if the insulation resistance as shown by reference to periodic test data, is reasonably high. The increased temperature from normal operation will drive small amounts of moisture from the windings.

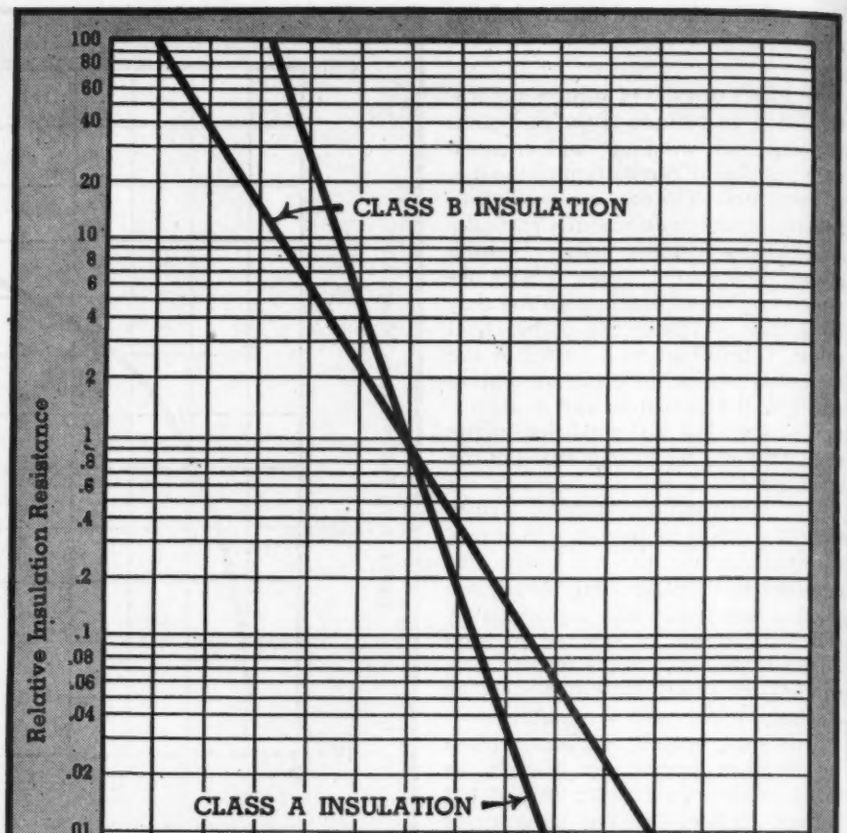


Figure 3. General effect of temperature on the insulation resistance of Class A and Class B insulation

Where the insulation resistance fails as a result of dirt or excessive moisture, it can be brought up to a proper value in most cases of good design, and where no defect exists, by cleaning with a suitable solvent if necessary and by drying.

With the application of heat the insulation resistance at the start will usually decrease rapidly, but as the process of drying becomes effective the resistance will increase, finally reaching a value that is approximately constant.

Continue drying well beyond time at which the insulation resistance has started to increase after reaching a minimum, and preferably until it approaches constancy.

The effect of temperature variations on insulation resistance readings is particularly noticeable during dryout runs. As far as is possible take readings at constant temperature, once the machine is heated.

6. Effect of humidity on insulation. Humidity is one of the chief contributing factors to dangerously low insulation resistance. It is therefore desirable to consider the manner in which it affects insulation characteristics.

High relative humidity affects insulation in two ways. If the insulation is porous, moisture will be absorbed into the body of the material, while, if moisture wets the surface, a thin film of water is formed covering the whole surface. Water distributed throughout the interior of an insulator produces interfacial polarization, which causes an increase in capacitance, dissipation factor, and volume conductivity. The amounts of these increases vary with the relative humidity and inversely with the frequency.

At 100 percent relative humidity and a frequency of 60 cycles, increases of as much as 50 percent in capacitance, of a millionfold in conductivity, and up to a dissipation factor of 1, are quite possible for such porous materials as filled and laminated thermo-setting plastics, many thermo-plastics, and natural fibers such as cotton, wool, and silk.

Insulation resistance can be measured by a self-contained instrument such as the direct-indicating ohmmeter of the generator, battery or electronic type, a resistance bridge, or with a milliammeter, a voltmeter, and a d.c. supply. As an expedient where no insulation testing device is available it can be measured by a high-resistance voltmeter with suitable d.c. supply.

Motor-operated battery or rectifier units are necessary for taking long-time tests of the dielectric absorption type. Hand-operated instruments are suitable for short-time single readings.

When using any type of d.c. voltage source, it is essential that the output voltage be very steady to prevent fluctuation in charging current.

Where protective resistors are used in test instruments their effect on the magnitude of the voltage applied to the insulation under test must be taken into account.

The instrument used in insulation resistance testing must be well maintained. Make periodic checks to insure that rated voltage is delivered and that the instrument is in calibration.

Take care when using either self-contained instruments or a d.c. supply that the voltage applied to the windings is restricted to a value commensurate with the voltage rating of the winding and the condition of the insulation to be tested. This precaution is particularly important with small, low-voltage machines, or wet or water-soaked units, when the applied potential may actually overstress the insulation, if too high a voltage is used.

Insulation resistance tests ordinarily should be made on each winding with all other windings connected to ground. If the windings are normally connected together and cannot readily or conveniently be separated the test may be made on all windings together to ground.

Insulation resistance tests of a complete winding to ground do not provide a check of the insulation between windings. Therefore, if an abnormally low reading is obtained for the entire winding a special effort ought to be made to separate the windings and test each separately with the others grounded. This is essential in locating the circuit or part responsible for the low value.

The connected leads, cables, switches, and other external equipment may markedly influence the value of insulation resistance of a machine. Either isolate such external equipment or make sure that its insulation resistance is higher than that of the machine to be tested.

As mentioned before, with large or important machines discharge the windings to ground for at least 10 minutes before an insulation resistance test is made.

Statistical analysis of a large number of a.c. machine windings disclosed some very interesting data regarding the average volume resistivity and the range of variation. These data are reported in the table on this page and illustrated in Figure 4.

This information will be found useful in estimating the insulation resistance of the solid insulation (disregarding surface leakage) of new, clean, dry windings of the types reported. Surface leakage reduces these values in varying degrees, depending upon the machine design characteristics.

It is commonly recognized that no general rules can be presented for the actual insulation resistance values for machines, since it varies with type, size, speed, voltage rating, kind and condition of insulating materials used, method of construction, and history of service. However, AIEE and ASA have suggested in several standards and test codes formulas for minimum values for new machines. The more common of these formulas, including some recently suggested modifications, are:

For synchronous machines:

$$R_i = t\frac{E}{\frac{Kva.}{100} + 1000}$$

The minimum insulation resistance of the field windings of machines separately excited with voltage less than the rated voltage of the machine should be on the order of $\frac{1}{2}$ to 1 megohm at 75 deg. C.

For polyphase induction machines:

$$R_i = t\frac{E}{\frac{Hp.}{134} + 1000}$$

For direct-current machines:

$$R_i = t\frac{E}{\frac{Kw.}{100} + 1000}$$

With d.c. fractional-horsepower motors disregard the formula and use 1 megohm as the minimum acceptable value at 75 deg. C.

For railway motors:

$$R_i = t\frac{E}{\frac{Hp.}{134} + 1000}$$

For single-phase machines:

$$R_i = t\frac{E}{\frac{Hp.}{134} + 1000}$$

With fractional-horsepower motors disregard the formula and use 1 megohm at 75 deg. C. as the minimum acceptable value.

In the foregoing formulas:

E = Machine rating in line-to-line volts
$Kva.$ = Machine rating in kilovolt-amperes
$Kw.$ = Machine rating in kilowatts
$Hp.$ = Machine rating in horsepower
t = Temperature factor = 1 at 75 deg. C.

These formulas do not include resistance of brush-holders, brush-holder supports, or field windings because they vary greatly in type and construction. It is necessary to raise brushes from the commutator or collector rings when measuring the insulation resistance of armatures.

Because of improvements in insu-

Average Resistivity and Standard Deviation of Common Classes of Insulation

Type of Insulation	Average Volume Resistivity, Megohm-Inches	Standard Deviation, Megohm-Inches	Percent Dispersion
Class A (With mica slot insulation)	60×10^6	33×10^6	55
Class B (With glass-reinforced mica slot insulation	135×10^6	56×10^6	42
Class B (Continuous mica tape with synthetic varnish impregnation)	58×10^6	37×10^6	64

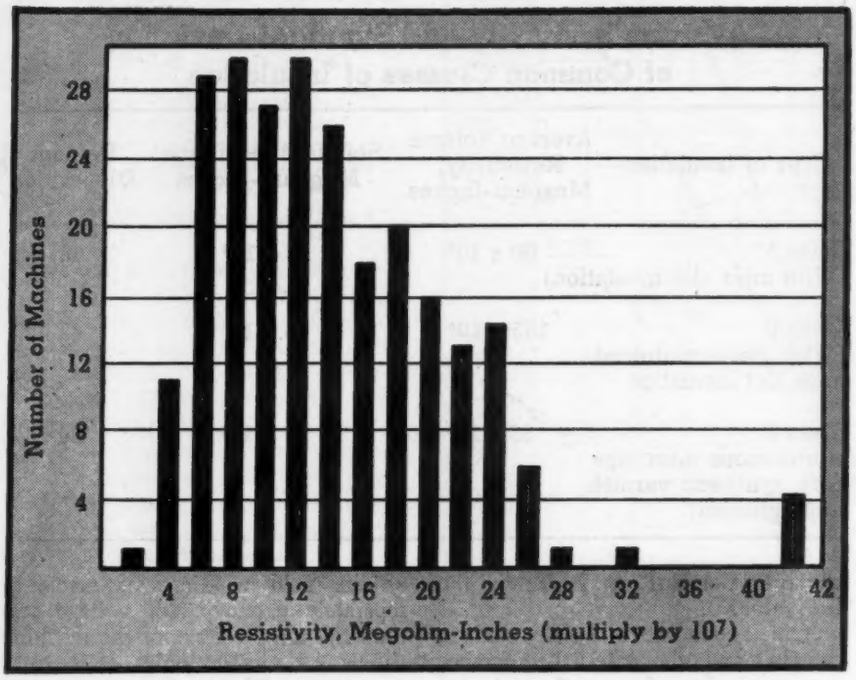


Figure 4. Frequency distribution of volume resistivity (1-min. value) for Class B, with glass-reinforced slot, insulation on large a.c. machines

Insulation Resistance Test Record

Original Machine (New, Clean, and Dry)

Time of Voltage Application, Minutes	Insulation Resistance, Megohms		
	Armature	Main Field	Comm. Field
1/4			
1/2			
3/4			
1*			
1 1/2			
2			
4			
6			
Winding Temperature			

*Basic Bench Mark

Inspection Data (One-Minute Insulation Resistance)

Date	Air	Armature		Main Field		Comm. Field		Insulation Condition
	Temp.	Meg.	Temp.	Meg.	Temp.	Meg.	Temp.	

Figure 5. Here is a convenient form for recording the results of insulation resistance tests on d.c. machines, in order to study trends

lation and variations in the treatment and dryness of windings, actual values of 100 times these minimums are possible. Large variations above the minimums are not necessarily indicative of a change in insulation quality or insulation dielectric breakdown strength. Values below these minimums, however, indicate the desirability of preventive maintenance. Causes for low insulation resistance ought to be investigated and where necessary windings should be reconditioned, cleaned, and dried.

It must be remembered that, even assuming that the dielectric strength of insulation decreases with reductions in resistivity, the voltage breakdown resistivity varies widely between materials and is subject to wide variation for the same material.

Study the Data

Since general rules for positive insulation resistance minimums cannot be established, it is necessary to use insulation resistance data for comparison. Data ought to be collected periodically and studied for trends. Figure 5 shows a typical form for recording test data from d.c. machines. In order to rationalize such data corrections must be made for temperature, and the other variables must be controlled.

This procedure is suggested:

1. Periodically observe insulation resistance of all important equipment at a standard voltage (preferably 500 volts d.c.) and time of voltage application (preferably 1 minute), using standard test equipment for recording the winding temperature.

2. Tabulate the recorded data, correcting observed values for temperature and any other known variables.

3. Plot a curve of subsequent readings for each machine and observe the trends with allowance for seasonal variation in atmospheric humidity.

4. When unusual changes occur in insulation resistance, make a further study of the machine to determine the cause. The exact source of trouble frequently can be located by isolating circuit components or by exploring the creepage surfaces with a probe.

5. Make insulation resistance tests before and after each high-potential test. Changes in insulation resistance should be investigated.

When similar machines have the same order of insulation resistance value, and maintain these values for long periods, it is reasonable to assume that they are in safe operating condition. Wide changes in relative insulation resistance (corrected for temperature) ought to be investigated.

It must be remembered that high insulation resistance is not positive assurance of high dielectric strength. On the other hand, low insulation resistance should be considered a warning of probable trouble.

EXIDES HELP TO KEEP MATERIALS MOVING *SMOOTHLY, STEADILY,* ALL DAY LONG...

Lifting and shifting, loading and unloading, hauling and stacking—the lowest materials handling costs are assured when unit loads are handled by electric industrial trucks.

When your electric industrial trucks are Exide-powered, you can count on *full shift availability* day after day. There is no costly down time, for Exides stay steadily on the job, delivering the same efficient performance during every working hour—a factor that makes Exide-powered electric industrial trucks the most economical of all materials handling units. When you buy an Exide you buy dependability, long-life and ease of maintenance.

Write us for a FREE copy of the bulletin "Unit Loads," prepared by The Electric Industrial Truck Association. It tells how to cut handling costs up to 50% ... covers latest developments in materials handling ... and includes actual case histories.

ARMY E NAVY

Exide
BATTERIES

THE ELECTRIC STORAGE BATTERY CO., Philadelphia 32 • Exide Batteries of Canada, Limited, Toronto

Mechanical Power Transmission Equipment

Mechanical power transmission equipment introduced to you by *Factory* during the past 12 months is reviewed here to give you a quick one-year summary

BELT DRESSING—Known as Grako, is claimed to increase transmission capacity 20 percent or more. Regular use is said to lengthen life and keep belting pliable and transmission capacity high. Adaptable for conditions where steam and water are troublesome. Graton & Knight Company, Worcester, Mass.

HYDRAULIC TRANSMISSION—Featuring continuous duty performance under varying conditions of load and speed, Model HT-1 hydraulic transmission is for heavy-duty applications. Portman Machine Tool Company, New Rochelle, N. Y. (Figure 1)

LINK JOINT—Type H universal link joint features adjustable link mechanism to transmit rotary motion around corners. Permits operation of shafts at angles adjustable from a straight line to a right angle. Applicable for hand operation and slow speed power drives. Piezoelectric Corporation, New York. (Figure 2)

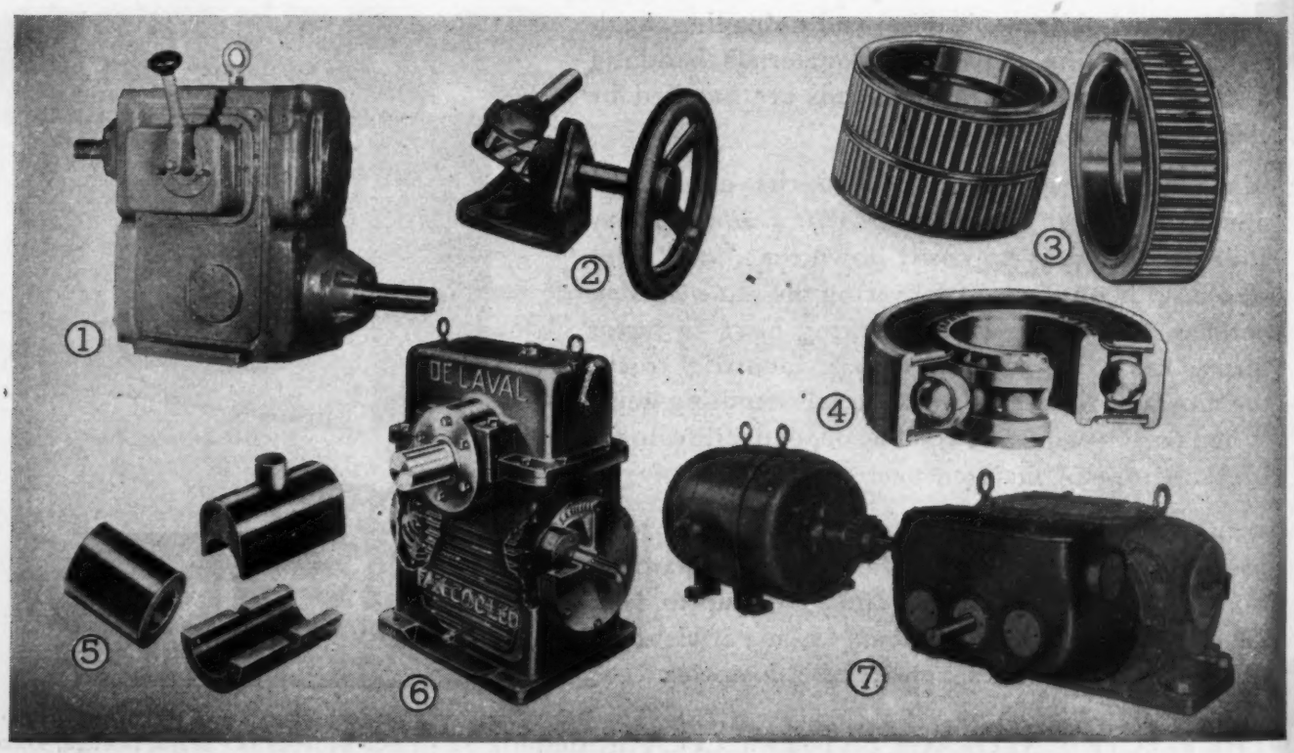
ROLLER BEARING—Type IR inner race and roller assembly Solidend Multirol bearing may be used where parts that have been heat-treated can be utilized as outer raceways. Made in both single and double row. The McGill Manufacturing Company, Inc., Valparaiso, Ind. (Figure 3)

SEALED BALL BEARING—Known as Plya-Seal, has a diaphragm-type contact seal comprising two members—a flat, flexible sealing washer, and a split retaining ring of spring steel. The Fafnir Bearing Company, New Britain, Conn. (Figure 4)

SELF-LUBRICATING BEARINGS—are stated to be immune to acids, alkali, and most solvents, and to have low coefficients of friction and expansion. Composed of carbon, graphite, or both, they give cooperating surfaces a protective coating. Will not impart odor or taste to liquids. Morganite Brush Company, Inc., Long Island City, N. Y. (Figure 5)

SPEED REDUCER—Worm gear speed reducer employs forced air cooling to remove the heat, doubling capacity of gear for practically all ratios and sizes at 1750 r.p.m., maker states. This permits use of smaller and lighter speed reducers. De Laval Steam Turbine Company, Trenton, N. J. (Figure 6)

VARIABLE-SPEED DRIVE—consisting of two mechanical differentials and a standard Link Belt PIV variable-speed reducer, features constant torque throughout entire range. Using an 1800 r.p.m. squirrel-cage motor as a source of power, output speed can be obtained from 0 to 800 r.p.m. in one direction, or from 400 r.p.m. forward through 0 to 400 r.p.m. reverse. The Ohio Gear Company, Cleveland. (Figure 7)



We built the skill of the craftsman into the machine!

If every raceway for a Hyatt Roller Bearing were painstakingly fashioned by expert tool makers they could be no more concentric or of more uniform wall thickness than obtained by our centerless grinding machine production.

First we externally grind by our improved arborless grinding method. Then the perfect outside periphery thus obtained is used as a guide in grinding the inner diameter of outer races, the track upon which the rollers operate.

This new principle invented several years ago by Hyatt Methods and Equipment Engineers we call "Chuckless Grinding." Thus into the machine we built the skill of the craftsman and precision manufacture at a mass production pace was born.

This is just another example of the many exclusive manufacturing processes which enable us to build accuracy, longer life and more dependable performance into Hyatt Roller Bearings for every application.

* * *

Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

HYATT ROLLER BEARINGS

MAINTENANCE SHORTS

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary maintenance accomplishments. Accepted articles will be paid for

FIFTY DOLLARS

Will be paid for the best Maintenance Short published in each issue of *Factory* until further notice. (Do not submit Shorts that deal with production processes.)

All other Shorts accepted for publication will be paid for at attractive rates.

Contributors may submit as many items as they wish. Mail yours today!

Prize-winning short this month, "Revolving Spray Booth Speeds Finishing Operation" on page 166

Repairing Joints in Compressed Air Hose

H. B. McDERMID, Cincinnati

Joints in the hose of a compressed air line in an oil yard, where cold rivets had to be used because of the fire hazard, were being subjected to excessive wear. The repairman was furnished good hose clamps, but they were unequal to the job.

Finally a cheap, fast method of repair was evolved. The nipple was first notched and inserted in the hose as usual. Then a piece of 18-gage soft iron wire, about 3 feet long, was used to bind the nipple on. For a winding tool a short piece of hard wood was prepared as follows: Two ¼-in. holes were drilled near one end, about 1½ inches apart, and parallel to each other. The wire was threaded, first through the hole farthest from the end of the stick, then through the second hole, leaving one end of the wire long enough to be gripped in a vise beside the hose and nipple.

The vise is set moderately tight, and the wire is wound around the hose, binding it on the notched nipple, with the loose end of the wire gripped against the handle of the tool loosely enough to provide proper tension. For a neat job, the wire strands are wound on close together for about an inch, then the ends are twisted together, bent over, and tapped lightly into the body of the hose, where they cannot hurt a workman's hands.

A discarded hammer handle, about 8 inches long, makes an ideal tool, after the point has been tapered so that it can work close to the vise.

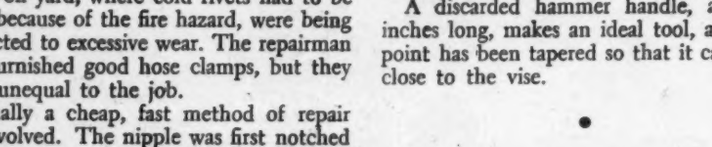
•

Adapts Tap for Use in Limited Space

LEON N. LOEB, East McKeesport, Pa.

It is often necessary to tap a hole in some place where limited room makes the use of a tap holder impossible. If a ratchet wrench is not available, I have found that the best way out is to weld the head of a recessed setscrew to the wrench end of the tap. Then, by the use of a suitable hex wrench, it is usually possible to tap the hole without difficulty.

The size of setscrew head used depends, of course, on the size of the tap used as well as on the material in which the hole is to be tapped.



•

Totepan Truck Reduces Worker Fatigue

RUSSEL E. KACHER, Chief Draftsman, Parts Index Department, The Monitor Controller Company, Baltimore

Totepans full of brass and steel parts are heavy. Dragging such loads from place to place around a factory is enough to fatigue any handler long before quitting time.

We therefore built a truck especially to handle these totepans. It has several features worthy of mention:

Hand truck, specially built to handle totepans of brass and steel parts, makes handler's job much easier

1. It is easy to construct. It can be built in any shop that has the means to shear sheet metal and weld parts together.

2. It is sturdy enough to carry two filled totepans without overloading.

3. The load is well balanced. This means ease of handling. There is a stop against which pans are pulled to balance the load.

4. The pans do not have to be lifted on and off the truck.

5. The truck can be used also for carrying dies between the die storage room and the punch presses. Heavy dies can thus be moved easily, and sets of dies can be moved in one trip.

(*Shorts continued on page 166*)

If it's welding fittings or flanges,

It's in the complete Tube Turns line!

MORE than 4,000 different items make up the complete Tube Turns line. Whatever you need, in whatever quantity, can be supplied by your nearest Tube Turns distributor. There are Tube Turns distributors in all principal cities, and all of them carry comprehensive stocks to help you avoid delays when speed counts.

Tube Turns introduced the first seamless welding fittings. The complete Tube Turns line is today the product of years of successful experience—of meeting the demands of industry as they arose. Familiarity with every phase of modern piping practice, gained in the creation of the complete Tube Turns line, is an "extra" you get when you do business with us. Back of every distributor stands the nearest Tube Turns branch office, backed up by the home office engineering staff.

Your Tube Turns distributor can be of real help to you. Get acquainted with him now. And write today for your free copy of Tube Turns Catalog No. 111, a 240-page handbook of welding fittings information.

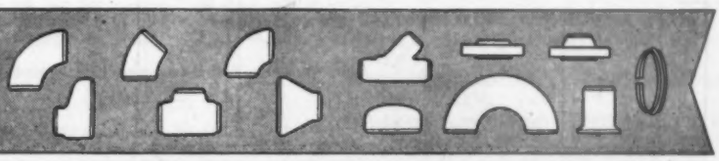
Selected Tube Turns distributors in every principal city are ready to serve you from complete stocks.

TUBE TURNS (Inc.), Louisville 1, Kentucky. Branch Offices: New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Dayton, Washington, D. C., Houston, San Francisco, Seattle, Los Angeles.

ARMY E NAVY M

TUBE-TURN

TRADE MARK



THE COMPLETE LINE OF WELDING FITTINGS AND FLANGES

Revolving Spray Booth Speeds Finishing Operation

[(Continued from page 166)]

HARVEY KEHL, Foreman, Maintenance Department, The Lincoln Electric Company, Cleveland

The revolving paint spray booth shown in the illustration broke a production bottleneck and has afforded several distinct advantages. Among these advantages are greater ease of painting and better removal of fumes. It was designed and built by the maintenance department.

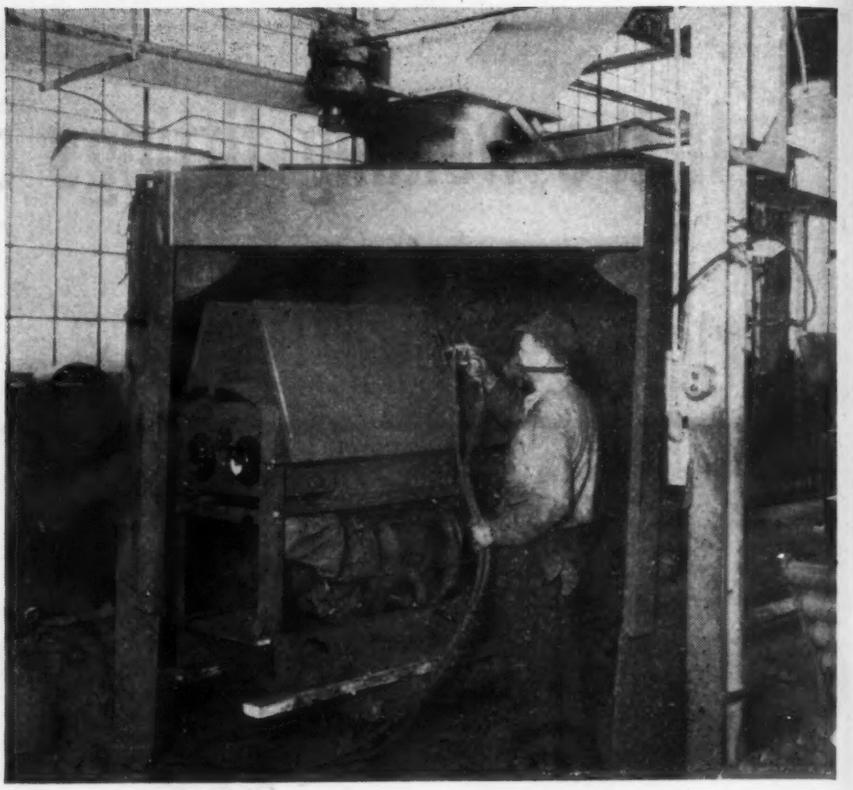
This booth is located on the main assembly line for engine-driven welders, which are carried through the various operations on small trucks whose wheels run in channel irons laid 20 inches apart. A quick drying enamel is used for finishing the welders so that by the time they have moved 40 feet up the assembly line they are dry and ready for crating.

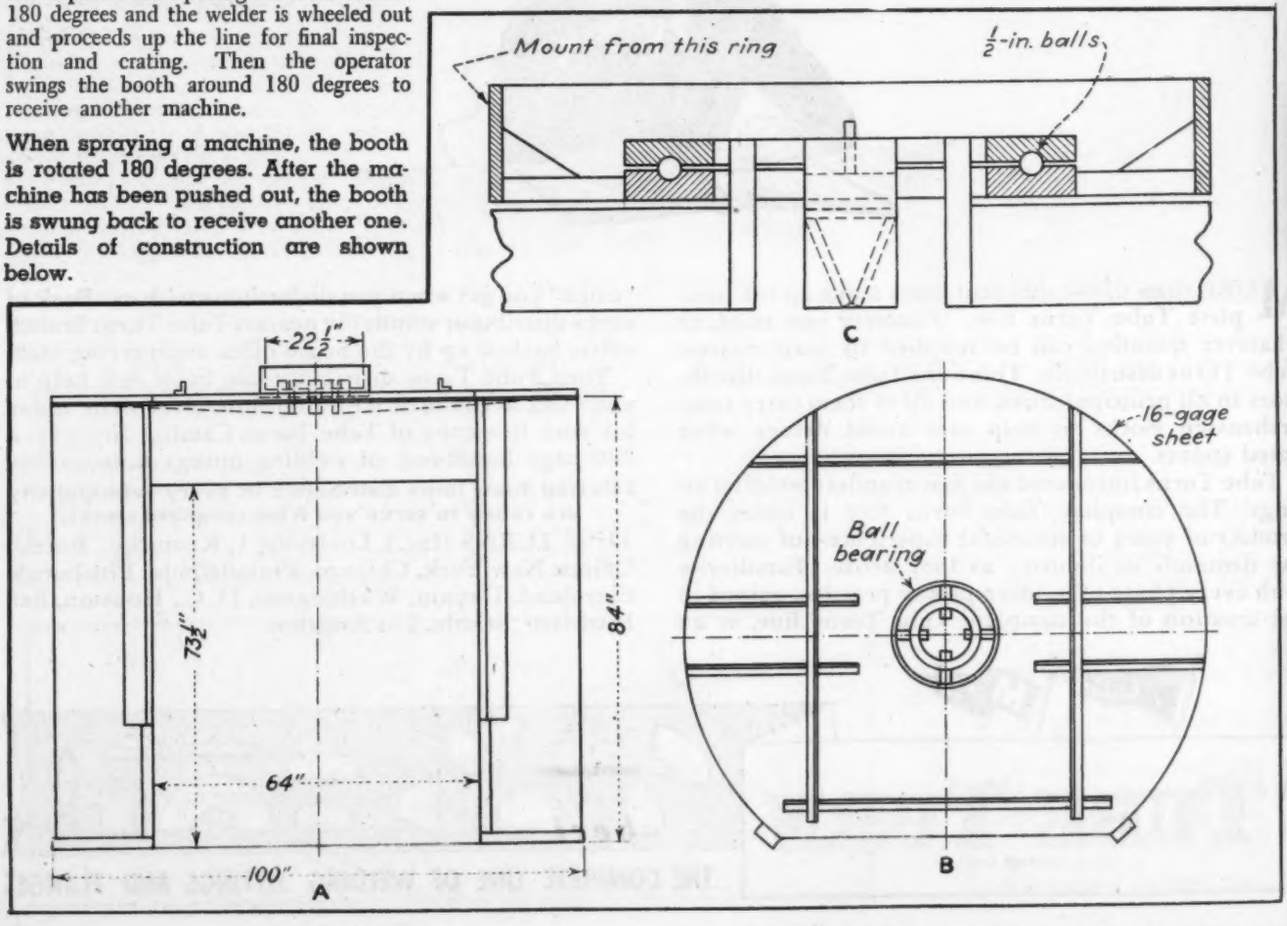
The booth was made of 16-gage sheet, diagrams A and B, which is supported and stiffened by small angle irons, as shown. An inexpensive ball bearing about 18 inches in diameter, supports the booth, as shown in sectional view C, and permits it to be turned around with little effort.

The motor above the booth drives a 24-in. suction fan that pulls out 8000 cubic feet of air per minute through the 22½-in. exhaust duct.

In operation, top right, a welder unit assembled and ready for painting, is pushed into the booth through the opening. As the operator sprays the machine he pulls the booth around so that when spraying is completed the opening has been rotated 180 degrees and the welder is wheeled out and proceeds up the line for final inspection and crating. Then the operator swings the booth around 180 degrees to receive another machine.

When spraying a machine, the booth is rotated 180 degrees. After the machine has been pushed out, the booth is swung back to receive another one. Details of construction are shown below.

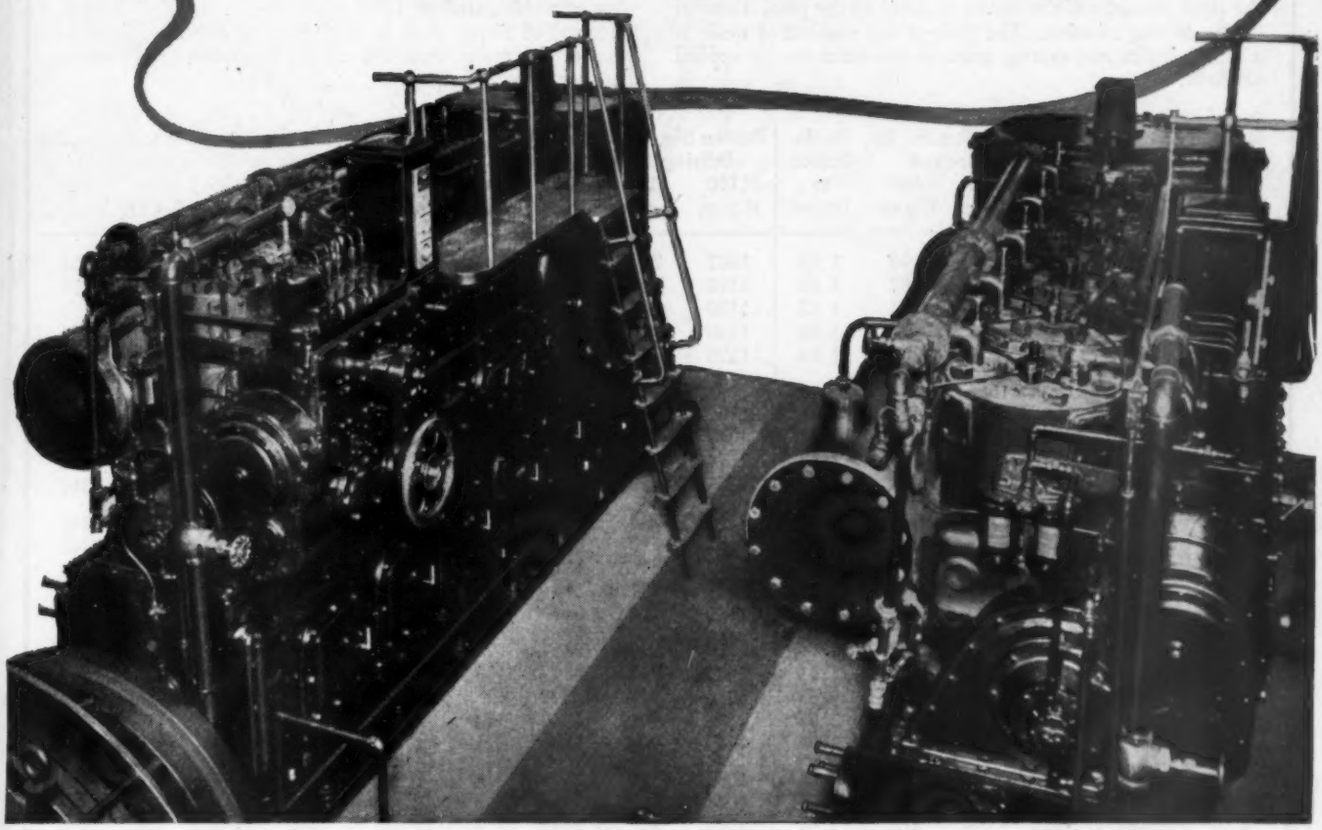




Fairbanks-Morse Diesels

Score $10,000 Saving

for Textile Mill



For years the big Bourne Mills of Fall River, Mass., operated a steam plant for two-thirds of their power needs and bought the remainder at an annual cost of $36,000 to $40,000.

Then two 500-hp. Fairbanks-Morse Diesels were installed. These two heavy-duty Diesels are now producing power for less than eight-tenths of a cent per kw-h.

At this rate the annual saving on all costs for operation and maintenance is almost exactly $10,000.

A Fairbanks-Morse engineer will tell you how much Diesel power can save in your plant. Write Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Ill.

Fairbanks-Morse

A name worth F M *remembering*

Diesel Locomotives • Diesel Engines
Scales • Motors • Pumps • Generators
Magnetos • Stokers • Railroad Motor Cars and Standpipes • Farm Equipment

Driven Shaft Speeds

BY USE OF THE TABLE BELOW, the speed of a driven shaft of a mechanical power drive can be found for various full-load motor speeds if the ratio of the pitch diameters of the driving and driven sheaves, sprockets, or gears, or the diameters of the pulleys, are known. This ratio can be derived by dividing the pitch diameter of the driven member by the pitch diameter of the driving member. The ratio of the number of teeth in a set of driven and driving gears or sprockets can be applied similarly.

Within the ratio limits of 1.00 and 4.00, in ratio increments of 1/100, the table shows the speed of the driven shaft in r.p.m. for full-load motor-driving speeds of 1750, 1155, 865, and 690 r.p.m. For example, if the ratio of the pitch diameters of the driven and driving sheaves of a V-belt transmission using a motor rated at 1750 r.p.m. full-load speed is 2.50, the speed of driven shaft is 700 r.p.m. If the rated full-load speed of the motor were 690 r.p.m., the speed of the driven shaft would be 276 r.p.m.

Ratio, Driven to Driver	Driven Shaft Speeds, R.p.m., for Driving Motor Speeds of 1750 R.p.m.	1155 R.p.m.	865 R.p.m.	690 R.p.m.	Ratfo, Driven to Driver	Driven Shaft Speeds, R.p.m., for Driving Motor Speeds of 1750 R.p.m.	1155 R.p.m.	865 R.p.m.	690 R.p.m.	Ratio, Driven to Driver	Driven Shaft Speeds, R.p.m., for Driving Motor Speeds of 1750 R.p.m.	1155 R.p.m.	865 R.p.m.	690 R.p.m.
1.00	1750	1155	865	690	1.45	1207	797	597	476	1.90	921	608	455	363
1.01	1733	1144	856	683	1.46	1199	791	592	473	1.91	916	605	453	361
1.02	1716	1132	848	676	1.47	1190	786	588	469	1.92	911	602	451	359
1.03	1699	1121	840	670	1.48	1182	780	584	466	1.93	907	598	448	358
1.04	1683	1111	832	663	1.49	1174	775	581	463	1.94	902	955	446	356
1.05	1667	1100	824	657	1.50	1167	770	577	460	1.95	897	592	444	354
1.06	1651	1090	816	651	1.51	1159	765	573	457	1.96	893	589	441	352
1.07	1636	1079	808	645	1.52	1151	760	569	454	1.97	888	586	439	350
1.08	1620	1069	801	639	1.53	1144	755	565	451	1.98	884	583	437	348
1.09	1606	1060	794	633	1.54	1136	750	562	448	1.99	879	580	435	347
1.10	1591	1050	786	627	1.55	1129	745	558	445	2.00	875	577	434	345
1.11	1576	1041	779	622	1.56	1122	740	554	442	2.01	871	575	430	343
1.12	1563	1031	772	616	1.57	1115	736	551	439	2.02	866	572	428	342
1.13	1549	1022	765	611	1.58	1108	731	547	437	2.03	862	569	426	340
1.14	1535	1013	759	605	1.59	1101	726	544	434	2.04	858	566	424	338
1.15	1522	1004	752	600	1.60	1094	722	541	431	2.05	854	563	422	337
1.16	1509	996	746	595	1.61	1087	717	537	429	2.06	850	561	420	335
1.17	1496	987	739	590	1.62	1080	713	534	426	2.07	854	558	418	333
1.18	1483	979	733	585	1.63	1074	709	531	423	2.08	841	555	416	332
1.19	1471	971	727	580	1.64	1067	704	527	421	2.09	837	553	414	330
1.20	1458	963	721	575	1.65	1061	700	524	418	2.10	833	550	412	329
1.21	1446	955	715	570	1.66	1054	696	521	416	2.11	829	547	410	327
1.22	1434	947	709	566	1.67	1048	692	518	413	2.12	825	545	408	325
1.23	1423	939	703	561	1.68	1042	688	515	411	2.13	822	542	406	324
1.24	1411	931	698	556	1.69	1036	683	512	408	2.14	818	540	404	322
1.25	1400	924	692	552	1.70	1029	679	509	406	2.15	814	537	402	321
1.26	1389	917	687	548	1.71	1023	675	506	404	2.16	810	535	400	319
1.27	1378	909	681	543	1.72	1017	672	503	401	2.17	806	532	399	318
1.28	1367	902	676	539	1.73	1012	668	500	399	2.18	803	530	397	317
1.29	1357	895	671	535	1.74	1006	664	497	397	2.19	799	527	395	315
1.30	1346	888	665	531	1.75	1000	660	494	394	2.20	795	525	393	314
1.31	1336	882	660	527	1.76	994	656	491	392	2.21	792	523	391	312
1.32	1326	875	655	523	1.77	989	653	489	390	2.22	788	520	390	311
1.33	1316	868	650	519	1.78	983	649	486	388	2.23	785	518	388	309
1.34	1306	862	646	515	1.79	978	645	483	385	2.24	781	516	386	308
1.35	1296	856	641	511	1.80	972	642	481	383	2.25	778	513	384	307
1.36	1287	849	636	507	1.81	967	638	478	381	2.26	774	511	383	305
1.37	1277	843	631	504	1.82	962	635	475	379	2.27	771	509	381	304
1.38	1268	837	627	500	1.83	956	631	473	377	2.28	768	507	379	303
1.39	1259	831	622	496	1.84	951	628	470	375	2.29	764	504	378	301
1.40	1250	825	618	493	1.85	946	624	468	373	2.30	761	502	376	300
1.41	1241	819	613	489	1.86	941	621	465	371	2.31	758	500	374	299
1.42	1232	813	609	486	1.87	936	618	463	369	2.32	754	498	373	297
1.43	1224	808	605	483	1.88	931	614	460	367	2.33	751	496	371	296
1.44	1215	802	601	479	1.89	926	611	458	365	2.34	748	494	370	295

(Continued on page 170)

Headed your way

THE NEW BLACK ARROW LINE of Gas Cutting and Welding Apparatus. Black Arrow is the new, packaged line of high quality, precision-built Gas Cutting and Welding Apparatus. Products range from complete outfits through a broad selection of torches, tips, regulators, accessories and supplies.

You'll hear more about Black Arrow from your local distributor—soon.

BLACK

The **BLACK** MANUFACTURING CO.

1416-1428 W. BALTIMORE ST., BALTIMORE 23, MD.

FORMERLY THE ALEXANDER MILBURN CO.

PIONEERS IN GAS CUTTING AND WELDING APPARATUS SINCE 1907

Driven Shaft Speeds *(continued from page 168)*

Ratio, Driven to Driver	Driven Shaft Speeds, R.p.m., for Driving Motor Speeds of 1750 R.p.m.	1155 R.p.m.	865 R.p.m.	690 R.p.m.
2.35	745	491	368	294
2.36	742	489	367	292
2.37	738	487	365	291
2.38	735	485	363	290
2.39	732	483	362	289
2.40	729	481	361	288
2.41	726	479	359	286
2.42	723	477	357	285
2.43	720	475	356	284
2.44	717	473	355	283
2.45	714	471	353	282
2.46	711	470	352	280
2.47	709	468	350	279
2.48	706	466	349	278
2.49	703	464	347	277
2.50	700	462	346	276
2.51	697	460	345	275
2.52	694	458	343	274
2.53	692	457	342	273
2.54	689	455	341	272
2.55	686	453	339	271
2.56	684	451	338	270
2.57	681	449	337	268
2.58	678	448	335	267
2.58	676	446	334	266
2.60	673	444	333	265
2.61	670	443	331	264
2.62	668	441	330	263
2.63	665	439	329	262
2.64	663	438	328	261
2.65	660	436	326	260
2.66	658	434	325	259
2.67	655	433	324	258
2.68	653	431	323	257
2.69	651	429	322	257
2.70	648	428	320	256
2.71	646	426	319	255
2.72	643	425	318	254
2.73	641	423	317	253
2.74	639	422	316	252
2.75	636	420	315	251
2.76	634	418	313	250
2.77	632	417	312	249
2.78	629	415	311	248
2.79	627	414	310	247
2.80	625	413	309	246
2.81	623	411	308	246
2.82	621	410	307	245
2.83	618	408	306	244
2.84	616	407	305	243
2.85	614	405	304	242
2.86	612	404	302	241
2.87	610	402	301	240
2.88	608	401	300	240
2.89	606	400	299	239
2.90	603	398	298	238
2.91	601	397	297	237
2.92	599	396	296	236
2.93	597	394	295	235
2.94	595	393	294	235
2.95	593	392	293	234
2.96	591	390	292	233
2.97	589	389	291	232
2.98	587	388	290	232
2.99	585	386	289	231
3.00	583	385	288	230
3.01	581	384	287	229
3.02	579	382	286	228
3.03	577	381	285	228
3.04	576	380	285	227
3.05	574	379	284	226
3.06	572	377	283	225
3.07	570	376	282	225
3.08	568	375	281	224
3.09	566	374	280	223
3.10	565	373	279	223
3.11	563	371	278	222
3.12	561	370	277	221
3.13	559	369	276	220
3.14	557	368	275	220
3.15	556	367	275	219
3.16	554	366	274	218
3.17	552	364	273	218
3.18	550	363	272	217
3.19	549	362	271	216
3.20	547	361	270	216
3.21	545	360	269	215
3.22	543	359	269	214
3.23	542	358	268	214
3.24	540	357	267	213
3.25	538	355	266	212
3.26	537	354	265	212
3.27	535	353	265	211
3.28	534	352	264	210
3.29	532	351	263	210
3.30	530	350	262	209
3.31	529	349	261	208
3.32	527	348	261	208
3.33	526	347	260	207
3.34	524	346	259	207
3.35	522	345	258	206
3.36	521	344	257	205
3.37	519	343	257	205
3.38	518	342	256	204
3.39	516	341	255	204
3.40	515	340	254	203
3.41	513	339	254	202
3.42	512	338	253	202
3.43	510	337	252	201
3.44	509	336	251	201
3.45	507	335	251	200
3.46	506	334	250	199
3.47	504	333	249	199
3.48	503	332	249	198
3.49	501	331	248	198
3.50	500	330	247	197
3.51	499	329	246	197
3.52	497	328	246	196
3.53	496	327	245	195
3.54	494	326	244	195
3.55	493	325	244	194
3.56	492	324	243	194
3.57	490	324	242	193
3.58	489	323	242	193
3.59	487	322	241	192
3.60	486	321	240	192
3.61	485	320	240	191
3.62	483	319	239	191
3.63	482	318	238	190
3.64	481	317	238	190
3.65	479	316	237	189
3.66	478	316	236	189
3.67	477	315	236	188
3.68	476	314	235	188
3.69	474	313	234	187
3.70	473	312	234	186
3.71	472	311	233	186
3.72	470	310	233	185
3.73	469	310	232	185
3.74	468	309	231	184
3.75	467	308	231	184
3.76	465	307	230	184
3.77	464	306	229	183
3.78	463	306	229	183
3.79	462	305	228	182
3.80	461	304	228	182
3.81	459	303	227	181
3.82	458	302	226	181
3.83	457	302	226	180
3.84	456	301	225	180
3.85	455	300	224	179
3.86	453	299	224	179
3.87	452	298	224	178
3.88	451	298	223	178
3.89	450	297	222	177
3.90	449	296	222	177
3.91	448	295	221	176
3.92	446	295	221	176
3.93	445	294	220	176
3.94	444	293	220	175
3.95	443	292	219	175
3.96	442	292	218	174
3.97	441	291	218	174
3.98	440	290	217	173
3.99	439	289	217	173
4.00	438	289	216	173

on the waterfront—or inland—I. B. Equipment is doing a top-notch job of material handling

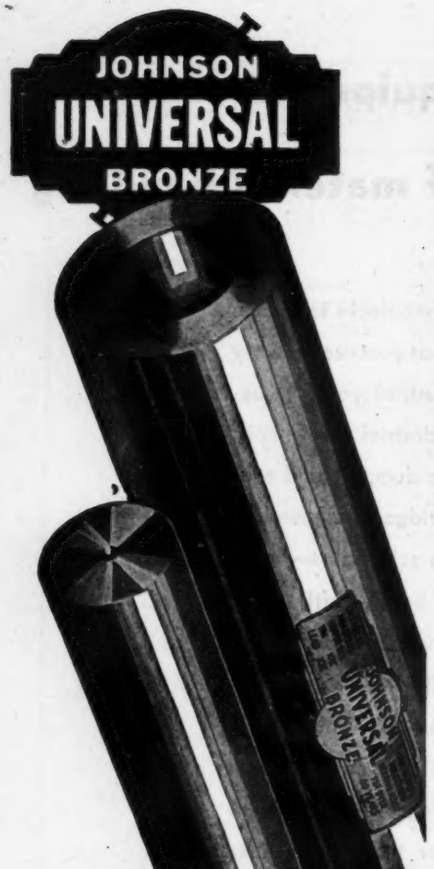
From Atlantic docks to Pacific ports, and at practically every major Industrial point in between, Industrial Brownhoist cranes, car dumpers and coal and ore bridges are speeding production schedules—slashing man hours—with their swift, economical handling of heavy, bulky materials. At left is shown an I.B. 40-ton Diesel Locomotive Crane which easily swings an army craft from water to flat car after trial run. Note patented Monitor-type cab which allows operator 360° visibility.

Right: I.B. 17-20 Ton Traveling Ore Bridge with 344 ft. bridge span and raisable apron extending 114 ft. from pier leg center line on dock side.

No matter where or what your material handling problems are, get the facts first from Industrial Brownhoist Corp., Bay City, Michigan. DISTRICT OFFICES: New York, Philadelphia, Cleveland, Chicago • Agencies: Detroit, Birmingham, Houston, Denver, Los Angeles, San Francisco, Seattle, Vancouver, B. C., Winnipeg, Canadian Brownhoist Ltd., Montreal, Quebec.

INDUSTRIAL BROWNHOIST BUILDS BETTER CRANES

JOHNSON
UNIVERSAL
BRONZE



TIME SAVER

You save two ways when you purchase Johnson UNIVERSAL Bronze Bars. First, the range of sizes . . . over 350 . . . enables you to buy exactly according to your needs. Then, every bar is completely machined I.D.—O.D. ENDS saving up to 25% in weight and eliminating costly machining. Every bar is entirely usable from end to end . . . no flaws or undersurface defects. Try a Johnson UNIVERSAL Bronze Bar on your next job.

Write for
STOCK LIST

JOHNSON BRONZE
512 S. MILL ST., NEW CASTLE, PA.

WHAT'S NEW IN EQUIPMENT

Eye Shield

For use in semi-hazardous jobs such as spot welding, light grinding, and woodworking, plastic eye shield weighing less than 1 ounce has been developed. Known as FeatherSpec, it has replaceable one-

piece plastic lens gripped in a suspension-lock frame. Green lens can be substituted for the clear one if work involves glare. Can be worn over prescription lenses. Willson Products, Inc., Reading, Pa.

Conveyor Lubricant

Lubricant for high-speed chain conveyors, known as Botlube, is claimed to be non-staining, soapless, non-corrosive, and to contain no oil. Has a wetting action, one drop covering a large area with a thin film, preventing overflow and spillage. It is automatically dispensed through any container with a petcock and needle valve. Turco Products, Inc., 6135 South Central Ave., Los Angeles 1.

Adjustable Loading Ramp

Ramp that may be moved up and down by means of an electric-hydraulic piston is now on the market. Hinged at the outer end to a roller, it can be moved forward or backward slightly as other end is raised or lowered. Hydraulic piston is powered by electric oil-pumping unit installed near entrance to building. Push-button station raises or lowers free end of ramp to height desired within its 66-in. range of operation. Joyce-Cridland Co., Dayton 3.

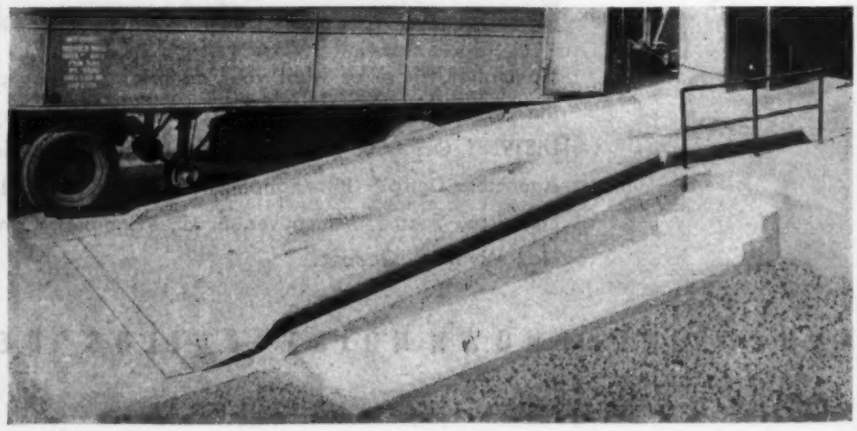
Paint

Designated as Pen-Kote 500, a general-purpose maintenance paint for use in plating plants and other high-humidity applications is announced. High in solids content, one coat is said to give protection, and two coats to be sufficient under difficult conditions. Free working, it can be applied by brush, dip, or spray. Surfaces to be protected need not be dry or extra-clean. On plating tanks and ductwork, corroded surfaces can be roughly wire-brushed, rinsed with water, and then painted. Can be applied on brick, wood, metal, paint, and other surfaces, wet, dry, hot, or cold, dries to a hard, semi-gloss finish in 30 minutes or less, and is odorless, manufacturer claims. Peninsular Chemical Products Co., 6795 East 9 Mile Rd., Van Dyke, Mich.

Lathe File

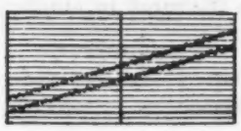
Long filing surface, blade replacement, and handling convenience, are features claimed for lathe file recently announced. The blanks have brazed-on nuts, and are at-

tached to the lightweight aluminum alloy handle by screws. Two types of blanks—fine, with 30 teeth per inch, and coarse, with 20 teeth per inch—are available.

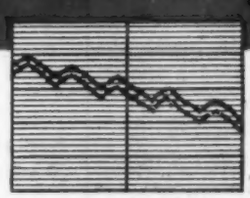


How to Check a Watch's Accuracy to 0.001% with RCA Electron Tubes

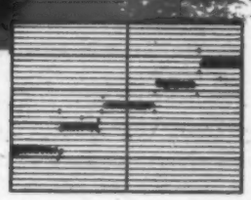
Electronic "WatchMaster," manufactured by American Time Products, Inc., New York City, uses RCA electron tubes to record watch-rate within 0.001% in only 30 seconds



This watch is running 60 seconds fast.



This watch is running 60 seconds slow. It has an eccentric escape wheel.



This watch is running 90 seconds fast. It has a defective escape tooth.

Before the Watch-rate Recorder was available, a week or more was required to adjust and time a watch. Moreover, watchmakers had to guess at causes of trouble.

THE ELECTRONIC METHOD—American Time Products' engineers developed an electronic method of measuring and permanently recording the rate of a watch. Seconds fast or slow are determined by comparison with a fixed frequency standard or time scale.

HOW IT IS DONE—The tick of the watch is picked up and amplified by a pair of RCA 6SJ7 tubes. The amplified tick controls an RCA-2050 thyratron tube, which energizes a stylus to make a dot on a revolving chart driven by a synchronous motor. Each dot on the chart corresponds to a single tick. If the watch is keeping correct time, the dots form a straight line across the chart. If the watch is fast, this line slopes upward; if slow, it slopes downward. The chart is so calibrated that a 30-second recording shows the timekeeping of the watch in minutes and seconds per day. The character of the pattern also indicates mechanical imperfections of the watch, such as worn pivots, lack of lubrication, eccentric balance wheel, defective escapement, and other irregularities.

The frequency standard or timing base in the WATCHMASTER is a special-alloy, compensated tuning fork, which has an accuracy of at least 0.001%. The fork energy is amplified by RCA tubes so that the output from an RCA 6L6G drives the synchronous motor that rotates the drum holding the chart paper at exactly five revolutions per second. This corresponds to the 5-tick-per-second rate of the ordinary watch. The tubes required are all low-price standard tubes available from any RCA dealer.

ADVANTAGES—Any watch not requiring replacement of parts or repair can be completely and accurately adjusted in two or three minutes—saving nearly a week's time for each watch. The adjustments are scientifically exact and do not require the services of a skilled watchmaker. Watches can be adjusted while the customer waits, and a visual record, in the form of a chart, can be delivered to him as evidence of the accuracy of his watch. If extensive repairs are shown to be necessary, the customer has evidence of this in the chart.

APPLICATIONS—The basic principles underlying the performance of the WATCHMASTER are applicable to any timing and control problems where high accuracy and short-interval timing are important. For example, a chronograph has been developed by American Time Products, Inc. that records time-intervals of several minutes to an estimated 0.001 of a second. Shaft speeds can be determined either stroboscopically or through calibration of tachometer equipment. Synchronous-motor speeds may be maintained accurately by direct drive or by means of auxiliary control. Secondary-frequency standards, useful in any general or research laboratory, can be manufactured to any practicable degree of accuracy.

TURN TO ELECTRONICS FOR SOLUTION OF YOUR OWN PROBLEMS — Electron tubes are providing a practical solution to hundreds of diversified manufacturing problems — process-control, machine-control, heat-treating of metals, plant-protection, and a host of others. Consult with RCA tube-application engineers for information or advice on the application of electronic tubes in your own plant For examples of present day uses of electron tubes in industry, send for a copy of the free booklet "16 Examples of Electron Tubes at Work in Industry." Write to RCA, Commercial Engineering Department, Section 62-59L, Harrison, N. J.

BUY BONDS BUY BONDS

THE FOUNTAINHEAD OF MODERN TUBE DEVELOPMENT IS RCA

RCA

62-6336-59

RADIO CORPORATION OF AMERICA

TUBE DIVISION · HARRISON, N. J.

"Metal-basting"... eliminating cumbersome, expensive jigs... with a few little staples to hold assemblies in position while welding... also saved 45% of *time* required to weld automobile gas tanks.

The tiny Bostitch staple... machine-applied... preformed or from a coil of wire ... speeds many fastening operations... in manufacturing, in paper work, in packing and shipping. A pottery manufacturer saved 50% in carton-sealing... a shoe manufacturer attached felt to wood heels 10 times faster... a softball manufacturer saved 70% in an important operation.

Investigate Bostitching — a growing production method—for fastening metal, plastics, wood, cloth, paper... in any combination... very often much faster, easier better than gluing, nailing, taping, etc.

Mail coupon for Folder B-154 which briefly covers representative models and may suggest an application that you can use to speed your fastening or lower your costs.

BOSTITCHING
offers you the most in stapling

Experience... EST. 1896 Nearly 50 years specializing in fastening.

Engineering... 18 research engineers.

Selection..... Nearly 800 models.

Service... Over 200 local representatives, all stapling specialists (300 prewar, 400 postwar).

Bostitch Staples in most sizes are now available

BOSTITCH
fastens it better AND FASTER with wire
ALL TYPES OF STAPLES APPLIED BY MACHINES
ALL TYPES OF MACHINES FOR APPLYING STAPLES

BOSTITCH (Boston Wire Stitcher Co.), 77 Blackmore St., East Greenwich, R. I. (Bostitch-Canada, Ltd., Montreal).

Please send Folder B-154 on Bostitch time-and-money-saving applications to:

Name.....

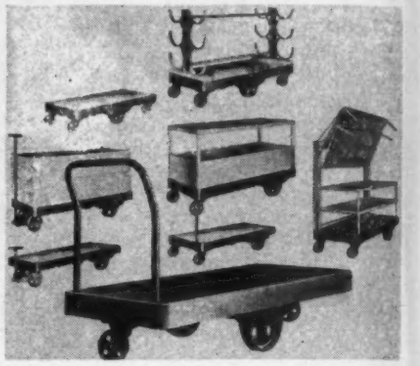
Company.....

Address.....

and are interchangeable on the same handle. Grip is shaped to fit the hand, and has a thumb rest and knuckle guard. An extension beyond the filing surface supplies a finger hold, and has a hole, permitting file to be hung up. Type F-45 is 13½ inches long over-all, with filing surface of ¾x8 inches, comprising two ¾x4-in. blanks, Kennametal Inc., Latrobe, Pa.

Industrial Trucks and Accessories

Stake pockets at each corner make it possible to convert industrial truck to suit different requirements by addition of standard accessories. Accessories can be attached to make it a box truck, leaf, shelf, rod and tube truck, or other combinations for specific needs. Deep section channels



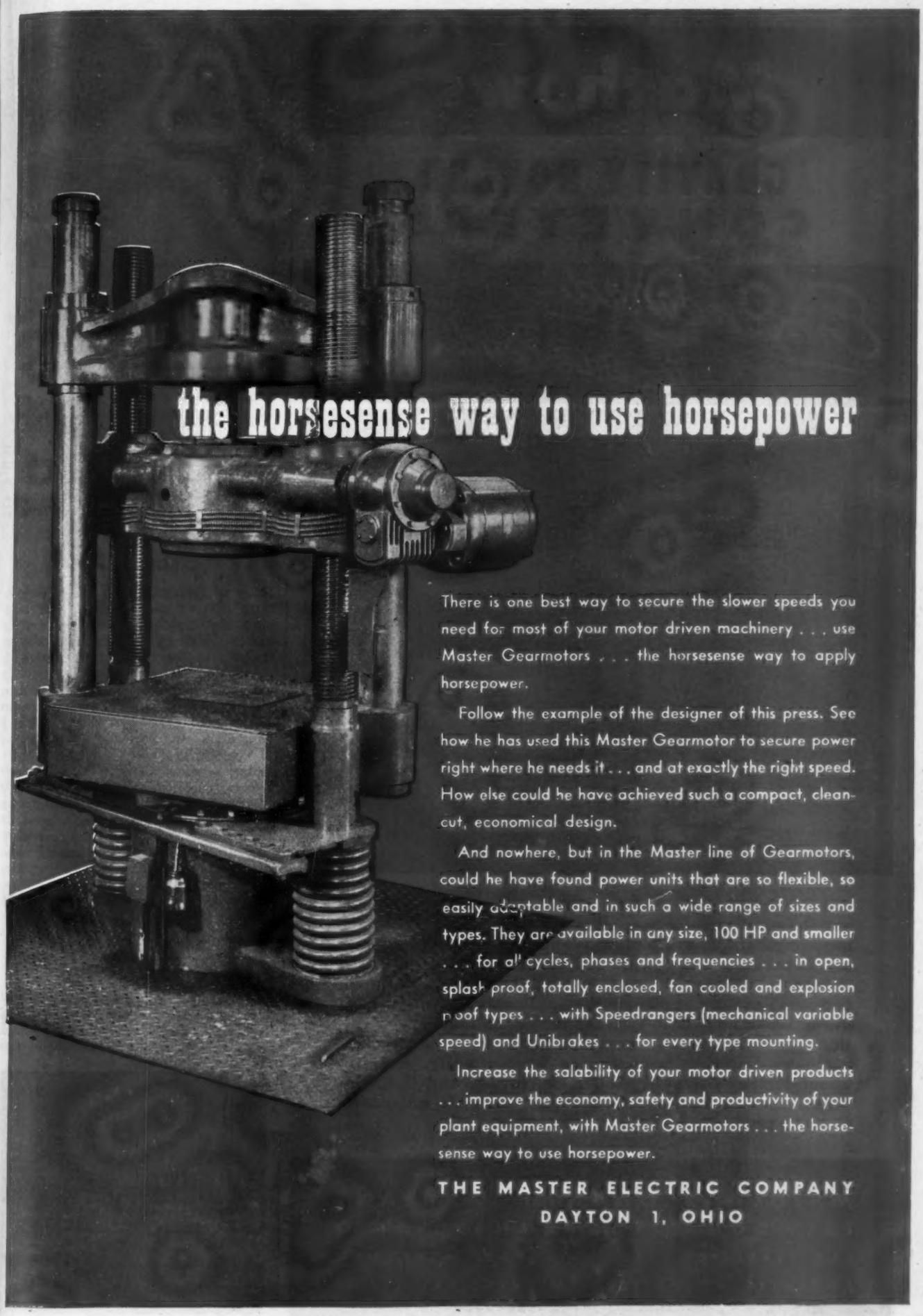
formed in one piece with the deck provide steel chassis with capacity up to 5000 pounds. Four additional channel cross members reinforce the deck. Under-carriage is designed to enable any one of the six caster and wheel arrangements to be adopted. Non-tilt and tilt types are interchangeable, and dolly types, wagon types, as well as six wheelers can be supplied. Trucks have rounded corners and edges, and splinter-proof deck. Market Forge Co., Garvey St., Everett 49, Mass.

Floor Covering

Lightweight non-slip composition, known as Ferrox, is a synthetic resin containing an abrasive. Adheres to metal, concrete, or wood surfaces, and may be applied by trowel or spray gun. It has a consistency about equal to fluid paste, and a coverage of 50 square feet per gallon. Manufacturer says that the compound can be walked on 4 to 6 hours after application, and that it withstands weathering, hard usage, and resists oil. The abrasive surface provides a grip for leather shoes or rubber boots. Comes in navy blue, red, black, and gray, in 1- and 5-gal. containers. American Abrasive Metals Co., Irvington, N. J.

Dial Thermometer

Bimetallic dial thermometer featuring permanently calibrated, accurate, and responsive precision helical coil measuring element, has case of alloy steel in different sizes, 18-8 stainless steel connection nut and stem, large numerals and temperature graduations on metal dial. Unbreakable glass crystal can be furnished. Expansion



the horsesense way to use horsepower

There is one best way to secure the slower speeds you need for most of your motor driven machinery . . . use Master Gearmotors . . . the horsesense way to apply horsepower.

Follow the example of the designer of this press. See how he has used this Master Gearmotor to secure power right where he needs it . . . and at exactly the right speed. How else could he have achieved such a compact, clean-cut, economical design.

And nowhere, but in the Master line of Gearmotors, could he have found power units that are so flexible, so easily adaptable and in such a wide range of sizes and types. They are available in any size, 100 HP and smaller . . . for all cycles, phases and frequencies . . . in open, splash proof, totally enclosed, fan cooled and explosion proof types . . . with Speedrangers (mechanical variable speed) and Unibrakes . . . for every type mounting.

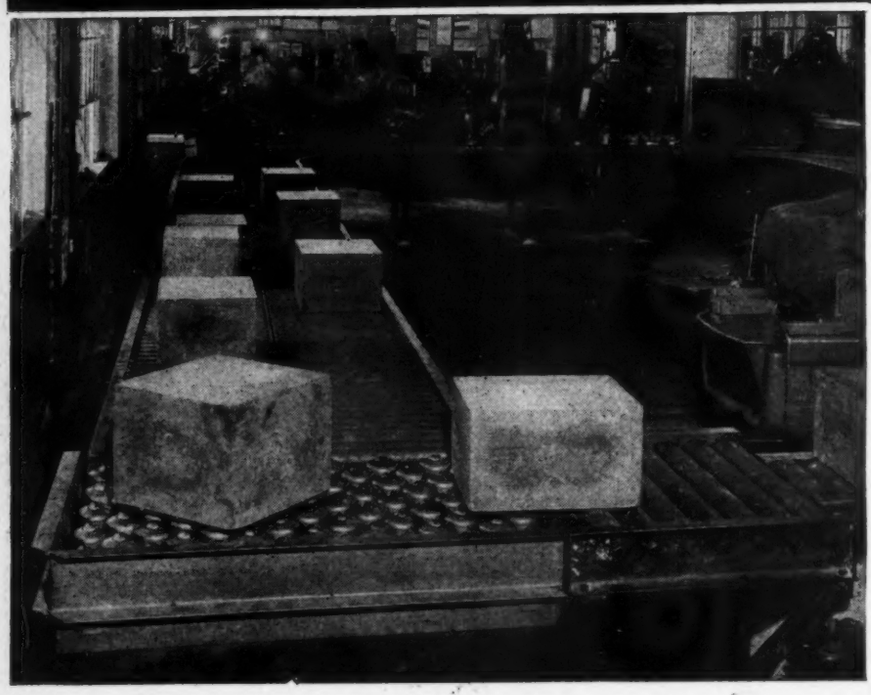
Increase the salability of your motor driven products . . . improve the economy, safety and productivity of your plant equipment, with Master Gearmotors . . . the horsesense way to use horsepower.

THE MASTER ELECTRIC COMPANY
DAYTON 1, OHIO

Mathews

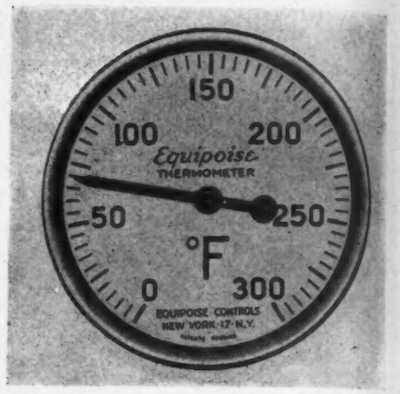
GRAVITY ROLLER CONVEYERS

Engineered to serve Production



Gravity Roller Conveyers are probably the most economical and the most commonly applied among all types of conveying equipment. The rollers are available in various diameters and capacities, and can be spaced at various centers in a number of different types of frames. The materials can be conveyed at right angles by the application of 90° Curves, or, as illustrated, Ball Transfer tables. Switches, frog sections, and hinges are common accessories. There is a Mathews Engineer operating in your vicinity. Ask him about Mathews Gravity Roller Conveyers, and the many other types of Mathews Conveyers which are engineered to serve production. Write or wire today.

MATHEWS CONVEYER COMPANY
ELLWOOD CITY, PENNSYLVANIA
SAN FRANCISCO, CAL. • PORT HOPE, ONT.
ENGINEERING OFFICES IN PRINCIPAL CITIES



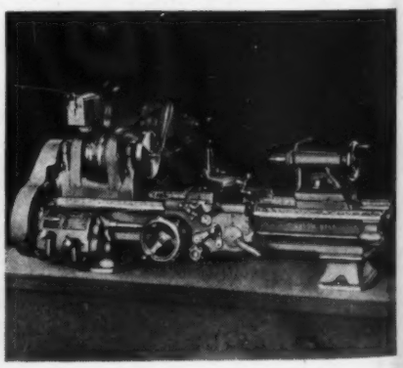
of bimetallic coil rotates attached small shaft and indicating pointer, as one unit over the scale range, is the only moving part. Construction protects thermometer against corosion, vibration, shock, and rough handling. Standard ranges are available between limits of 90 and 1000 deg. F. Temperature can be increased 50 percent or more beyond end of scale range without damage to thermometer for ranges up to 500 deg. F., 10 percent over range up to 1000-deg. F., maker states. Equipoise Controls, 342 Madison Ave., New York 17.

Gear Pullers

Series of matched gear pullers includes three sizes of standard units with maximum jaw capacities of 4½, 8½, and 14 inches. Small and medium sizes also are available in the slide-hammer design, or can be furnished with parts necessary for use as either standard or booster hammer pullers, adapting puller to characteristics of each job. Spring-controlled jaw lock is designed to give a safe, slip- and tip-proof grip on part to be pulled, maker states. Long jaws allow use of puller where shaft extends some distance through the gear or other part to be removed, and are slenderized to permit work in close places. On slide hammer type pullers, the centralized, guided shock of the booster hammer, combined with screw tension, provides pulling force, distributes pull equally, and removes the part. Snap-on Tools Corp., Kenosha, Wis.

V-Belt Lathe

Nine-inch precision bench lathe with V-belt drive features 4-step V-belt cone pulleys which, with the back gears, provide either 8 or 16 spindle speeds ranging from

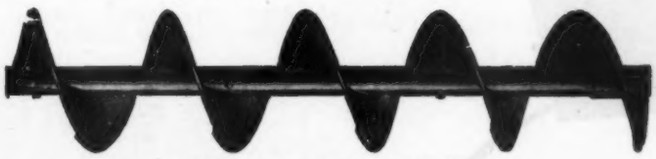


Jeffrey Parts FOR BETTER POWER PLANT OPERATION

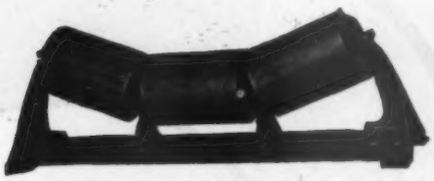
Transmission Bearings, Take-Ups, Gears, Pulleys, Clutches

Malleable Iron or Steel Buckets for every type elevator

Chains and Sprockets for Elevating, Conveying and Driving Service



Spiral Conveyor Flights and Fittings



Roller, Ball or Plain Bearing Belt Idlers in all standard widths

In the maintenance of power service you will do a better job at lower cost with Jeffrey replacement parts.

Illustrated are a few of the Standard parts made by Jeffrey to help you maintain dependable, efficient power service.

Save time—trouble—and continuous expense—specify Jeffrey.

Bottom and Side Discharge Valves

JM

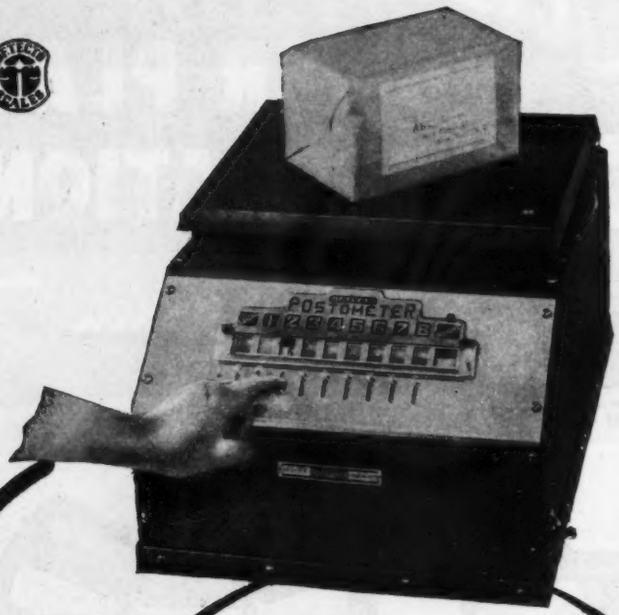
JEFFREY COMPLETE UNITS FOR THE POWER PLANT

TRACK HOPPERS · FEEDERS
ELEVATORS · CONVEYORS
SKIP HOISTS · WEIGH LARRIES
CRUSHERS

THE JEFFREY MANUFACTURING COMPANY
(ESTABLISHED IN 1877)
911-99 NORTH FOURTH STREET · · COLUMBUS 16, OHIO

SALES OFFICES: Baltimore 1, Birmingham 3, Boston 16, Buffalo 2, Chicago 1, Cincinnati 2, Cleveland 13, Denver 2, Detroit 13, Harlan, Houston 5, Huntington 19, Milwaukee 11, New York 7, Philadelphia 3, Pittsburgh 22, St. Louis 3, Salt Lake City 1, Scranton 3

DETECTO POST-O-METER



DETECTO ENDS GUESSWORK *in Postal Weighing*

Detecto Scales for industrial and commercial uses end guesswork in weighing — speed weighing operations — save time, money and reputation for the leaders of American industry.

No scale in the **Detecto** line illustrates this more than the Post-O-Meter, an automatic computing scale — sturdy, efficient, engineered to eliminate over-postage, zoning errors, "postage-due" delays. You simply press the right zone key and the CORRECT POSTAGE cost appears enlarged by a powerful magnifying glass. To double your shipping room efficiency get a **Detecto** Post-O-Meter—to end guesswork in every weighing operation throughout your plant call a **Detecto** Scale engineer today.

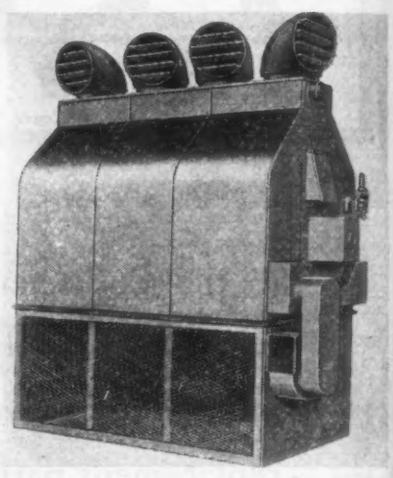
Send for catalog. Dept. **210**

DETECTO SCALES, INC.
ONE MAIN STREET · BROOKLYN, N. Y.

46 to 1176 r.p.m. It is made with either quick-change gear or plain change gear equipment for a range of thread cutting and power longitudinal feeds. Two of the models incorporate power cross feeds. Units have a 9¼-in. swing over the bed and saddle wings, and ¾-in. headstock spindle hole with maximum collet capacity of ½ inch. Different bed lengths give maximum distances between centers up to 34 inches. Attachments are available for special types of work. Lathe is suitable for metals, plastics, other materials. South Bend Lathe Works, 298 East Madison St., South Bend 22, Ind.

Direct-Fired Heaters

Ranging in capacity from 75,000 to 2,000,000 B.t.u. output per hour, direct-fired heaters for oil, gas, and coal are now on the market. The self-contained units are of steel, are equipped with automatic control systems, and can be used either for air distribution direct through rotatable diffusers, or through ducts. Advantages claimed for the heaters are: (1) Unit is



shipped in two sections; (2) filters may be applied without transformations requiring additional floor space; (3) low resistance through heater provides quiet fan operation and low motor horsepower; (4) tubes may be cleaned while standing on floor; (5) heater occupies little floor space; (6) has independent V-belt driven induced draft fan; (7) and has self-contained automatic thermostatically controlled humidification. Herbert H. Davis Co., Cicero, Ill.

Intercommunication System

Type S 415 self-contained desk console communication system is designed for two-way talk, paging, or soundcasting. The system permits master to master, or master to remote operation, with any number of stations up to 40. Pushbutton station selection is provided, and master key allows blanket calls to all stations. Buttons are self-locking, arranged in banks of ten, with release button for each bank. Master unit delivers 15 watts, is housed in walnut cabinet with pilot light, power switch, amplifier, and loudspeaker microphone. Booster amplifier can be added for large area coverage or special applications. Remote stations are available in several types for office, factory, or outdoor

Controls the air

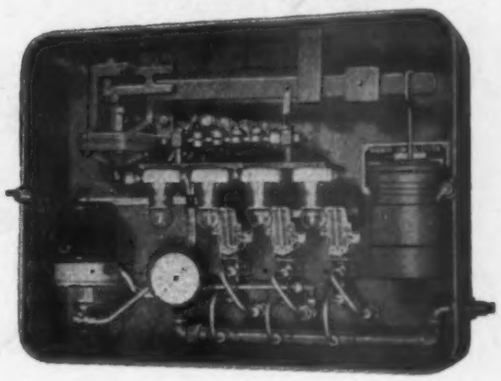
...TO FIT YOUR NEEDS!

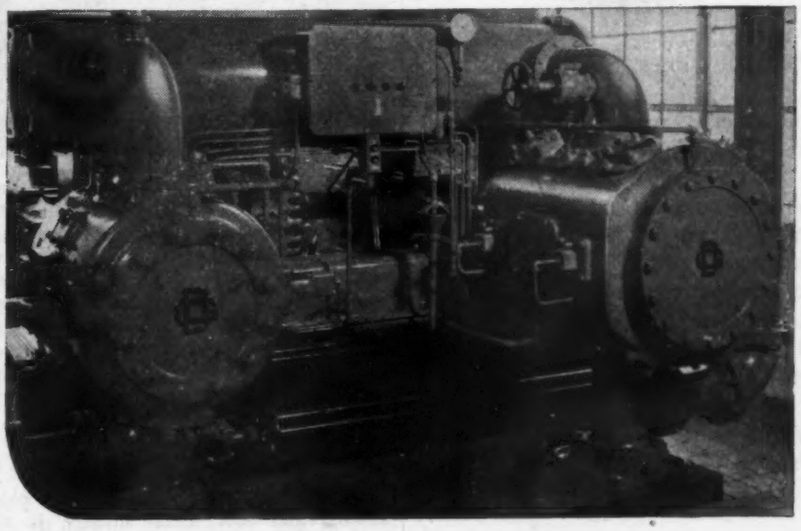
Control of the air—regulation of the flow. Here is a vitally important factor in operating efficiency of a compressor.

You get that positive control in the Gardner-Denver "HA" Horizontal Two-Stage Compressor. Designed for heavy duty, continuous service, the air output of the "HA" is automatically regulated to fit your needs.

Class M-25CS recycling five-step capacity control regulates the output in five steps . . . 100%, 75%, 50%, 25% and 0% of capacity. No wasted horsepower, no unnecessary wear on the compressor. Control is simple, extremely sensitive and without delicate adjustments or fragile parts.

Five-step recycling control.



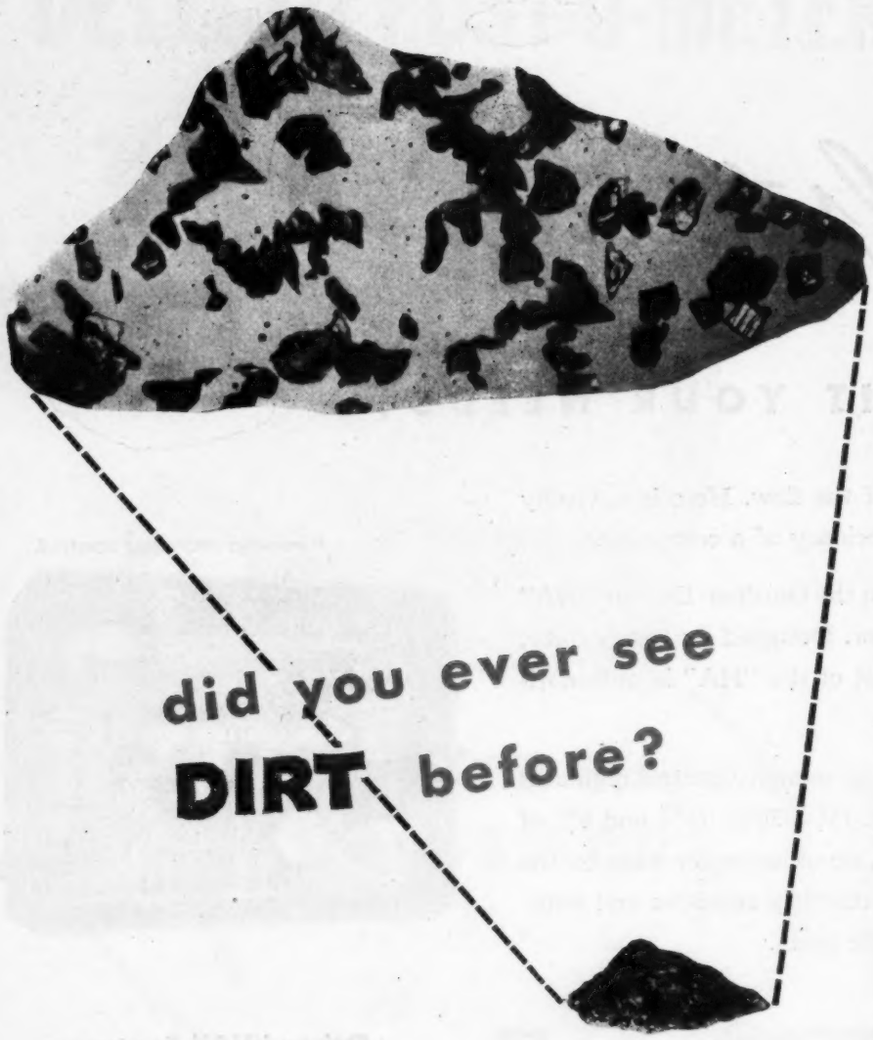


For complete information on the "HA," send for descriptive bulletin. Gardner-Denver Company, Quincy, Illinois.

Other "HA" Features

1. **Unrestricted air passages and large valve and port areas for greater air efficiency.**
2. **Timken main bearings for smooth, economical operations.**
3. **Large water-jacket areas for cooler running . . . lower discharge temperatures and lubricating economy.**
4. **Rugged, heavy-duty construction for long life and continuous service.**
5. **To reduce heat and moisture content of air further, for maximum hose and tool life, an efficient "Clean Air" after-cooler is available as additional equipment.**

GARDNER-DENVER *Since 1859*



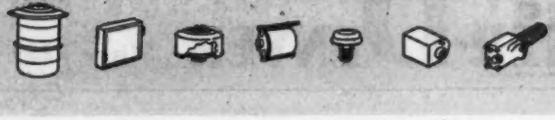
THIS is what it looks like, magnified 100 times. Sharp flint-like, often germ-laden.

Unfortunately, your products, machinery, merchandise or even customers and workers find dirt harmful—and without the help of a microscope.

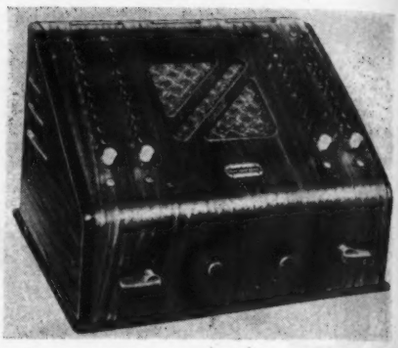
Wherever people, machinery, materials and processes are exposed to air, they are subject to the effects of air-borne dirt—infection, abrasion, contamination and the like.

Separating dirt from air is the job on which Air-Maze has specialized for nearly 20 years. Take advantage of this experience. Send your problems to us, or consult the yellow pages of your telephone directory for your nearest Air-Maze representative. Air-Maze Corporation, Cleveland 5, Ohio. *Representatives in principal cities. In Canada: Williams & Wilson, Ltd., Montreal, Quebec, Toronto, Windsor; Fleck Bros., Ltd., Vancouver, B. C.*

IF IT USES AIR . . . USE
AIR-MAZE
ENGINEERED AIR FILTRATION



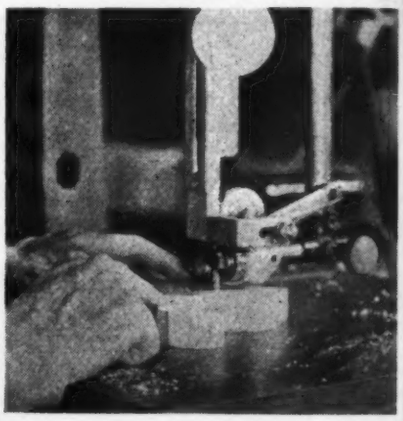
• Oil bath type filters and filter-silencers • Cleanable filter panels for air-borne dirt, oil, grease and liquids • Oil-wetted type filters and filter-silencers • Exhaust spark arresters • Gear case, crankcase and tank vent breathers • Oil-separators for engine crankcases • Full-flow type cleanable oil filters.



installation. All stations can originate calls. Power supply is standard 60 cycle, and tube complement is 2-7f7, 2-7c5, and 1-7z4. David Bogen Co., 663 Broadway, New York 12.

Bandsaw Guide

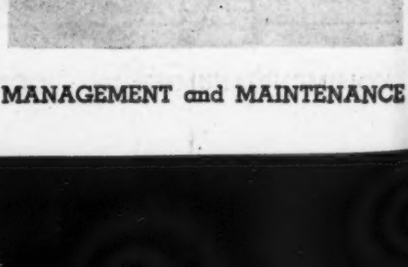
Featuring metal safety guard, bandsaw guide is adapted to metal and plastics as well as to wood, and is adjustable to blades ¼ to 1¼ inches wide. Side guide wheels are mounted in staggered position to eliminate binding. Grooved back wheel holds saw in position. Wheels are equipped with permanently lubricated ball bearings. Ad-



justment of mounting arm on supporting bracket is provided by setscrew which exerts pressure against 90-deg. pin that presses against adjusting screw. A 10-in. socket wrench is supplied for the setscrew and adjusting screw to move grooved wheel in and out for saws of different widths. Three models are available for saws of different sizes. The Boyer-Campbell Co., 6540 St. Antoine St., Detroit 2.

Wrench

Flare nut wrench, for use on plastic pipe, tubing, and soft metal fittings, is announced. Head is flat, based on a modified 12-point design, with opening allowing



IT'S THE

COMBINATION

THAT COUNTS IN

Glass

Photo, courtesy Hardwick Stove Co.

Transparency, of course...but other virtues, too

Transparency is the obvious reason for using glass in modern equipment for home and factory. But glass is selected for qualities not possessed by other materials.

The oven door in a modern stove is an example. For better visibility, the "window" is made of two panes of clear Tuf-flex tempered plate glass. Glass assures permanent transparency . . . transparency that is not affected by hard usage.

Tuf-flex has greater resistance to thermal shock than plate glass. For example, it withstands such rapid temperature change as caused by cold water being spilled on a hot oven door.

As a finish in kitchen equipment, glass is unexcelled. Heat won't craze it. It does not absorb liquids or odors. It cleans easily, quickly and doesn't need refinishing. Remember, too, that you can obtain glass in clear and colored, opaque and transparent, and in patterned forms.

Maybe you don't make stoves. But these and many other characteristics of glass may be just what you need for new products you are developing.

Before you design your products consider how glass can give them more efficiency and sales appeal. When may we discuss its potentialities with you? Libbey·Owens·Ford Glass Company, 57105 Nicholas Building, Toledo 3, Ohio.

Here's the combination that makes GLASS one of the world's most versatile materials:

CHEMICALLY, the most stable of all materials, except the noble metals. Won't rot, oxidize or disintegrate, plus—

DIMENSIONALLY STABLE. Coefficient of expansion extremely low. Keeps its shape, plus—

SURFACE, among the world's hardest and smoothest. Nonporous, won't absorb odors or moisture. More acid-resisting than any structural material. Unusual resistance to abrasion. Weathering qualities unequaled, plus—

STRONG, tempered glass is stronger than some metals. A square foot, ¼" thick withstands pressure of 45 lbs. per sq. in. and thermal shock of 466° F. Will not burn, plus—

ELECTRICAL INSULATOR of outstanding strength.

L O F

LIBBEY·OWENS·FORD

a Great Name in **GLASS**

Destructible? **Wood — Metal — Plastics — Glass. No material is indestructible. However, barring unforeseen conditions, no material will fail on a job in which it has been properly specified and engineered. When our application engineers say "Yes", you can be sure about glass.**

WIN THE PEACE

WITH THE

TURNER SYSTEM
OF MATERIALS HANDLING

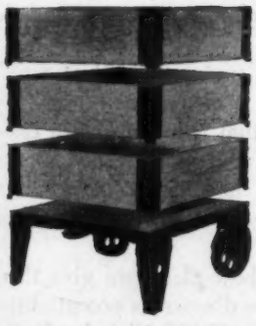
Our fighting men, backed by industry, have won the war. Now we must win the PEACE. To do it industry must operate with utmost efficiency. No works manager should be without complete information on the Turner System.

Confusion is the enemy of profit. Just consider what it would mean to your plant to have everything in perfect order — yet instantly available for transportation to any part of the shop. Removable Shelf Racks like these on movable Turner Transports will do the trick. Just one of many Turner features.

Standard Shop Boxes and Trays fit on this Box Rack.

BIN SECTIONS AND BOX RACKS ON TRANSPORTS

The Turner System provides an unlimited variation of co-ordinated accessory units, all readily movable on the Transport, to meet any storing or handling problem.



Portable Bin Sections may be removed as load diminishes, added as load increases.

WRITE FOR YOUR COPY OF BOOK ON TURNER SYSTEM

The features of the Turner System, as used by many of America's largest firms, are described in a 20-page book sent without charge to recognized companies.

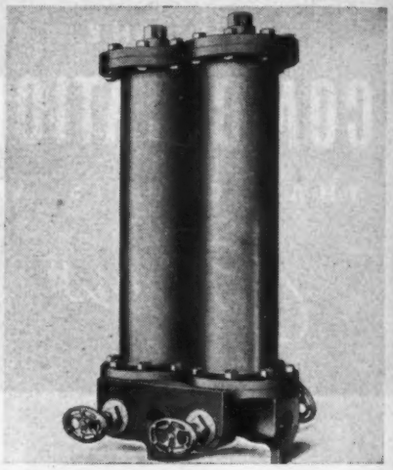
FACTORY SERVICE COMPANY

4605 N. TWENTY-FIRST ST. MILWAUKEE 9, WISCONSIN

access to fittings around tubing, and deep thin walls permit use in close places and small turning arcs. Damage to the fittings is prevented because of contact with the nut, and wrench cannot slip and chew it, maker states. Made in nine sizes, from ½ to 1⅛ inch. Plomb Tool Co., 2209 Santa Fe Ave., Los Angeles 54.

Water Filter

TF-1 model twin filter is a complete filter plant for applications where water must be cleaned for drinking and food purposes or for general industrial use. The



filter is self-contained and self-cleaning. Available in three types of filtering tubes for use on pre-filtered (city) water as well as cloudy water from rivers, lakes, and deep wells. R. P. Adams Co., Inc., 55 Chicago St., Buffalo.

Changes in Ownership

Acquisition of the B. F. Sturtevant Company, Boston, designers and manufacturers of air handling and processing equipment, is announced by Westinghouse Electric Corporation, Pittsburgh. The Sturtevant Company is now a wholly owned Westinghouse subsidiary, operating as the B. F. Sturtevant Company, a Division of Westinghouse Electric Corporation.

Menasco Manufacturing Company, Burbank, Calif., announces procuring business and assets of Malabar Machine Company, Los Angeles, designers and builders of high precision hydraulic equipment and aircraft engines. In operation the company will be identified as Malabar Machine Company, a Product Division of Menasco Manufacturing Company, Los Angeles.

Lifting Magnet

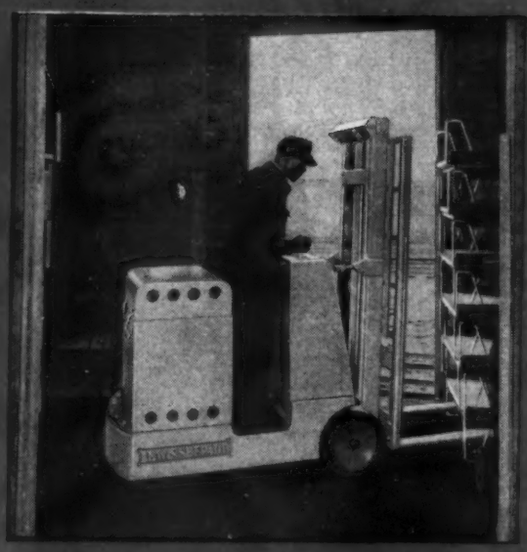
For general lifting magnet service, handling pig and scrap iron, slabs, castings, and similar materials, Type SW all-welded lifting magnet is announced. Metal-encased coil is hermetically sealed by continuous welds along inner and outer circumferences of coil-case and magnet-housing. Inner and outer pole shoes also are welded in place to form straight sides so that there is no overhang to catch on sides of railroad cars. Bolt-head recesses in side

KATHANODE *Guards* BATTERY EFFICIENCY

★

To give your electric truck more hours of trouble-free performance

Kathanode Positive Plate Assembly



Kathanode's exclusive glassklad construction minimizes loss of power producing active material. This means sustained useful power through more hours of trouble-free performance in your industrial truck.

Look at the Kathanode unit pictured above. Note how the plate extends below the mats and open-end envelope. Minute, spent particles of active material, filtering down through the mats, fall freely into the sediment chamber. There is no obstruction to cause them to lodge or tree. They cannot create short circuits and other internal cell losses.

Note also how the perforated rubber envelope holds the spun glass mats against the plate. No useful active material can escape. Capacity is maintained.

Kathanode reduces industrial truck power costs. Write Dept.110 for Catalog 100 on Gould Kathanode Glassklad Batteries for Industrial Truck and Tractor Service.

GOULD

PIONEER OF GLASSKLAD CONSTRUCTION

GOULD STORAGE BATTERY CORPORATION, Depew, N. Y.
Factories: Atlanta • Chicago • Dallas • Depew • Leavenworth • Los Angeles
North Bergen • Rock Island • St. Paul • Salem • Sioux City • Zanesville

LUBRIPLATE No. 130-A

LUBRICATION PLUS!

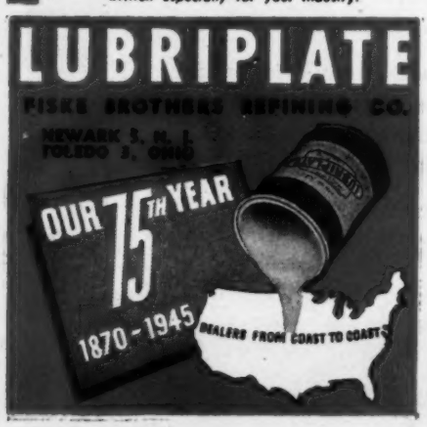
A SUPER LUBRICANT—A MARVELOUS ANTI-SEIZE COMPOUND—A REAL PROTECTION AGAINST RUST AND CORROSION. From the standpoints of general utility and wide diversity of important uses, we do not believe there has ever been a lubricant that compares with LUBRIPLATE No. 130-A. It has everything. The outstanding performance of this super-lubricant and its adoption by industry in general, and the Army and Navy are certainly adequate proof of its superiority. Write for copy of bulletin No. 6-41.

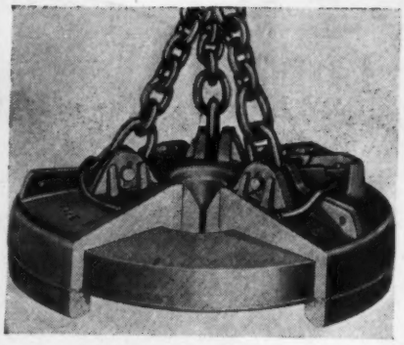
LUBRIPLATE
Lubricants definitely reduce friction and wear to a minimum. They lower power costs and prolong the life of equipment to an infinitely greater degree. LUBRIPLATE arrests progressive wear.

LUBRIPLATE
Lubricants protect machine parts against the destructive action of rust and corrosion. This feature alone puts LUBRIPLATE far out in front of conventional lubricants.

LUBRIPLATE
Lubricants are extremely economical for reason that they possess very long life and "stay-put" properties. A little LUBRIPLATE goes a long way.

Write for a booklet, "The LUBRIPLATE Film" written especially for your industry.





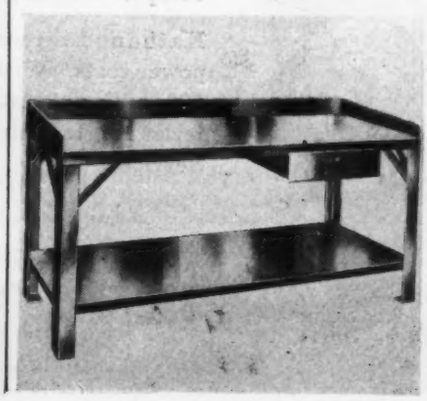
of magnet are eliminated, allowing wide interior space and permitting a coil of larger diameter. Coil-case, after welding, is vacuum-treated and filled with a compound, of high dielectric strength, which does not melt under heat or become brittle, according to maker. Water-tight construction of magnet permits its use in under-water applications and where moisture is excessive. The Electric Controller & Mfg. Co., Cleveland.

Germicidal Lamps

Claimed to provide ultra-violet radiation to destroy airborne bacteria, and to prevent contamination of foods as well as of sterilized articles, germicidal lamps are now available. Two types are offered in 15- and 30-watt T-8 sizes, and both are said to have 2500 hours of life. Type A is suitable for hospitals, lavatories, and sterilization of drinking glasses. Type B lamps can be used for meat storage refrigerators, air conditioning ducts, food packaging, canning, bottle and jar filling operations, and other applications where there is air turbulence, an exhaust canopy, or where provision is made for worker protection against the higher ozone output of these lamps. While special precautions must be observed in elimination of direct viewing by the naked eye, lamps may be operated with the ballasts, sockets, and starters used with standard 15- and 30-watt fluorescent lamps. Sylvania Electric Products, Inc., Salem, Mass.

Steel Workbench

Suitable for use as a workbench as well as for supporting light machine tools, a 12-gage steel workbench is now on the market. All four flanges of the bench are formed into a boxed edge, and a second steel plate may be tack welded to the top for vise reinforcement. Can be furnished



LUBRIPLATE No. 70

LUBRICATION FOR WHERE IT'S HOT AND WET!

LUBRIPLATE No. 70 is a medium density, grease type lubricant ideal for applications exposed to heat, steam and moisture. It does a wonderful lubrication job under all conditions. In processing and food plants where moisture, steam, heat and fumes are prevalent, it has no substitute. Machines lubricated with LUBRIPLATE No. 70 can be washed down with hot water without harming the lubricant in the bearings. LUBRIPLATE No. 70 prevents rust and corrosion.

℞ FOR YOUR MACHINERY

No. 2—Ideal for general oil type lubrication. Ring oiled bearings, wick feeds, sight feeds and bottle oilers.

No. 8—Because of its high film strength and long life reflects outstanding performance in most types of enclosed gears (speed reducers)

No. 107—One of the most popular grease type products for general application by pressure gun or cups.

No. 70—For a wide range of grease applications, especially at temperatures above 200 degrees F.

No. 130-AA—Known nationwide as the superior lubricant for open gears, heavy duty bearings, wire rope, etc.

BALL BEARING—This is the LUBRIPLATE lubricant that has achieved wide acclaim for use in the general run of ball and roller bearings operating at speeds to 5000 RPM and temperatures up to 300 degrees F.

Write for a booklet, "The LUBRIPLATE Film" written especially for your industry.

A FEW TIRED VALVES

CAN MAKE A WHOLE PLANT DOZE . . .

Worn-out valves at vital control points could make your entire plant lay down on the job. Valve failure is almost certain to interrupt work while repairs or replacements are made. Often it means ruin to materials in process. Sometimes, it brings serious danger to equipment and personnel.

Many valves which were nearing the retirement state before the war may now be dangerously close to complete collapse, as a result of carrying the abnormal service loads of wartime production. Trying to "revive" such valves is seldom worth the money and labor required.

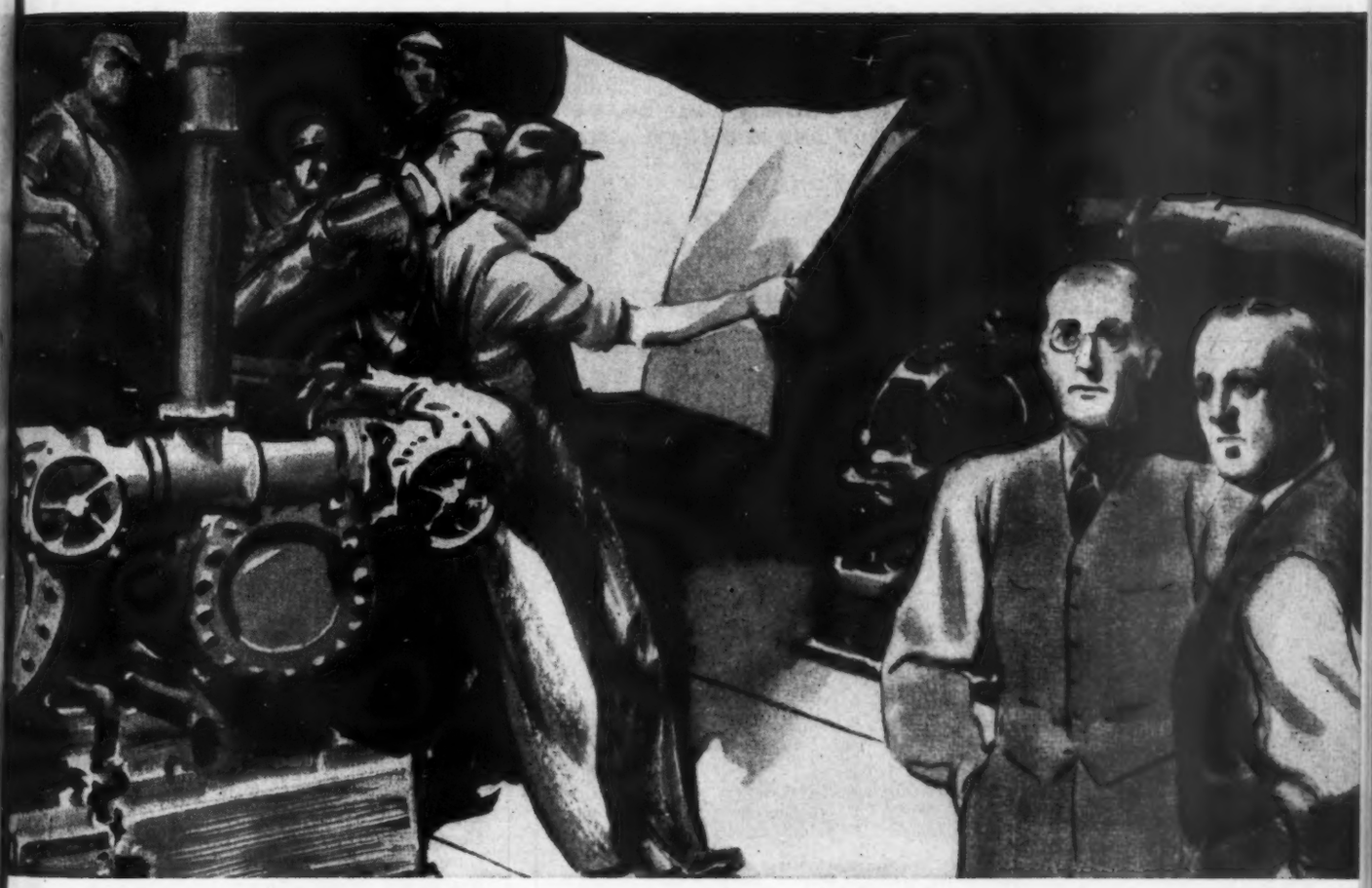
HOW TO SPOT "CRIPPLES" BEFORE THEY PUT YOU ON THE SPOT

Write for samples of the "Valve Record Sheets" prepared by Jenkins Engineers. Jot down the age and condition of every critical valve in your plant – its "trouble" record – and the cost of labor and parts for repairs. In this way you very quickly locate the points where new valves should be provided.

REPLACE WITH JENKINS VALVES . . . TO TAKE A LOAD OFF YOUR MIND . . . AND COST SHEET

For nearly a century Jenkins Valves have given dramatic demonstration of their low cost by remarkably long service records in thousands of installations throughout America. Jenkins Bros. better materials, better design, and better workmanship have always made a better valve. Over 600 patterns for every service are shown in the Jenkins Catalog.

Jenkins Bros., 80 White Street, New York 13; Bridgeport, Conn.; Atlanta, Boston, Philadelphia, Chicago, San Francisco. Jenkins Bros., Ltd., Montreal, London.



LOOK FOR THIS TRADE JENKINS MARK DIAMOND MARK

Jenkins Bros

JENKINS VALVES

SINCE 1864

For every Industrial, Engineering, Marine, Plumbing-heating Service . . . In Bronze, Iron, Cast Steel and Corrosion-resisting Alloys . . . 125 to 600 lbs. pressure.

Sold Through Reliable Industrial Distributors Everywhere

JENKINS BROS., 80 White St., New York 13, N. Y.

Please send me a set of the Jenkins "Valve Record Sheets"

Name.....

Company.....

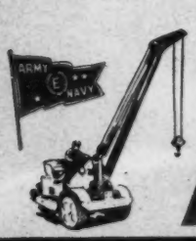
Address.....

.....

KRANE KAR lifts, transports, and positions the load. No need to maneuver the vehicle—swing the 'live' boom from side to side and up or down, by power, with full load on hook. KRANE KAR hauls trailers, spots cars, loads and unloads freight and cargo; moves, piles, and stacks loads of all shapes and sizes safely and efficiently. Ideal for maintenance and repair operations. KRANE KAR versatility speeds production output, lowers handling costs. Write for Catalog No. 58.

USERS: Basic Magnesium; Monsanto Chem.; Pullman; Standard Oil, General Motors; Chrysler Corp.; General Electric; Otis Elevator; Boeing Aircraft; Dupont, etc.

Agents in the Principal Cities



THE ORIGINAL SWING BOOM MOBILE CRANE
WITH FRONT-WHEEL DRIVE AND REAR-WHEEL STEER

2½, 5, AND 10 TON CAPACITIES

KRANE KAR
TRADE MARK REGISTERED

SILENT HOIST & CRANE CO., 855 63rd ST., B'KLYN 20, N.Y.

GRANT
BALL BEARING DRAWER SLIDES
assure safety and protection to precision machines and tools

Cabinet for precision bench lathe, designed and built in the Apprentice Shops of Bulova Watch Company. Both vertical and horizontal drawers are equipped with Grant Ball Bearing Drawer Slides.

Quick, easy installation of Grant Ball Bearing Drawer Slides can be made to practically any metal or wood cabinets, and smooth, finger-tip operation achieved. Furthermore, drawers are always level and can be withdrawn to permit complete accessibility without danger of falling out.

Precision tools and parts are assured full protection when stored in Grant-equipped drawers and costly repairs and replacements definitely minimized. In addition, contents of drawers are kept in neat order, because drawers are always smooth in operation. Provision is made for easy removal of drawers for cleaning.

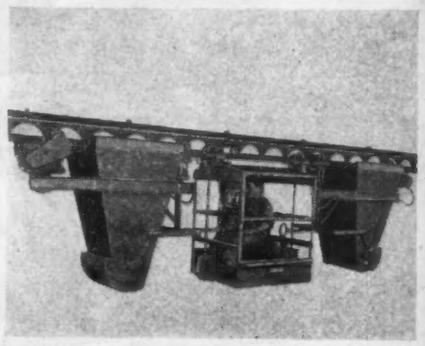
Grant Ball Bearing Drawer Slides are available in types and sizes for all purposes and capacities. Write for complete details.

GRANT PULLEY & HARDWARE CO.
30-42 57TH ST., WOODSIDE, LONG ISLAND, NEW YORK

without back and side railings for use as a packing bench, or supplied as a plain workbench with 12-gage steel top and with bottom tray, back and side railings, drawers with padlock attachment, and adjustable 3-compartment tray for drawer. Available in 42-in. and 6-ft. lengths, 34 inches high and 28 inches deep, benches may be placed side by side and back to back, forming large working surfaces in a minimum of floor space. The feet have holes for fastening to floor. Equipto, Div. of Aurora Equipment Co., Aurora, Ill.

Double Bucket Carrier

Motor-driven cab-operated double bucket carrier has been developed to transport dry bulk materials. Operation of carrier and opening and closing of bucket gates are handled by cab operator, who sits on swivel chair which enables him to work in direction of either bucket. Single variable speed drum controller is located on one side of cab, and two foot brakes are provided, one at either end. Push-pull levers



for opening bucket gates extend into cab and permit emptying the materials in amounts and at rate desired. Unit has two 25-cu.-ft. buckets, and is designed for carrying a total load of two tons. Carriers of other sizes can be supplied. Buckets are on tramrail arch beam rail for filling from overhead bins without interference or spillage. Carrier has two motorized travel drives, one at each end, and operates at speeds up to 600 feet per minute. Cleveland Tramrail Div., The Cleveland Crane & Engineering Co., Wickliffe, Ohio.

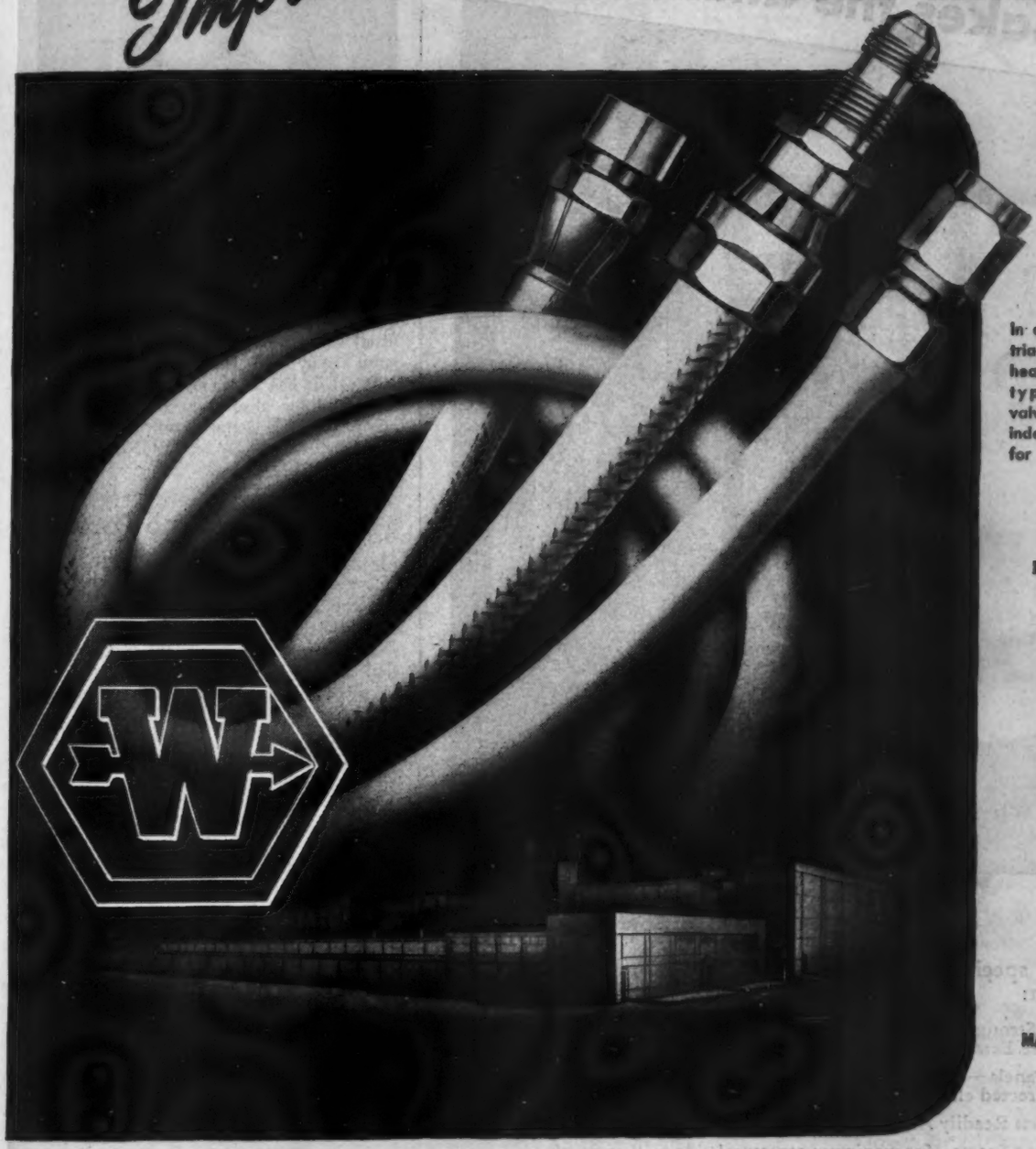
Change in Name

The Vulcanized Rubber Company, New York, and Morrisville, Pa., has changed its name to Vulcanized Rubber & Plastics Company. The plastics division of the company has been expanded and its research and manufacturing facilities have been enlarged.

Respirator Hoods

Designed to give head protection on jobs and operations involving dust and spray, respirator hoods are now on the market. Made of heavy-duty 10-oz. army duck, with full-vision, heavy-gage (0.040 inches) plastic windows, for impact resistance. Windows are replaceable without use of tools. Hood may be worn with or without correction glasses. Type GA-200 is for short-period use where dust volume makes breathing difficult without an air filtering

Improved INDUSTRIAL HOSE LINES



In addition to industrial hose, Weatherhead plants make all types of fittings, valves, hydraulic cylinders and other parts for these industries:

AUTOMOTIVE
★
REFRIGERATION
★
RAILROAD
★
MARINE
★
FARM EQUIPMENT
★
ROAD MACHINERY
★
DIESEL
★
L. P. GAS
★
APPLIANCE MANUFACTURERS

Look Ahead with

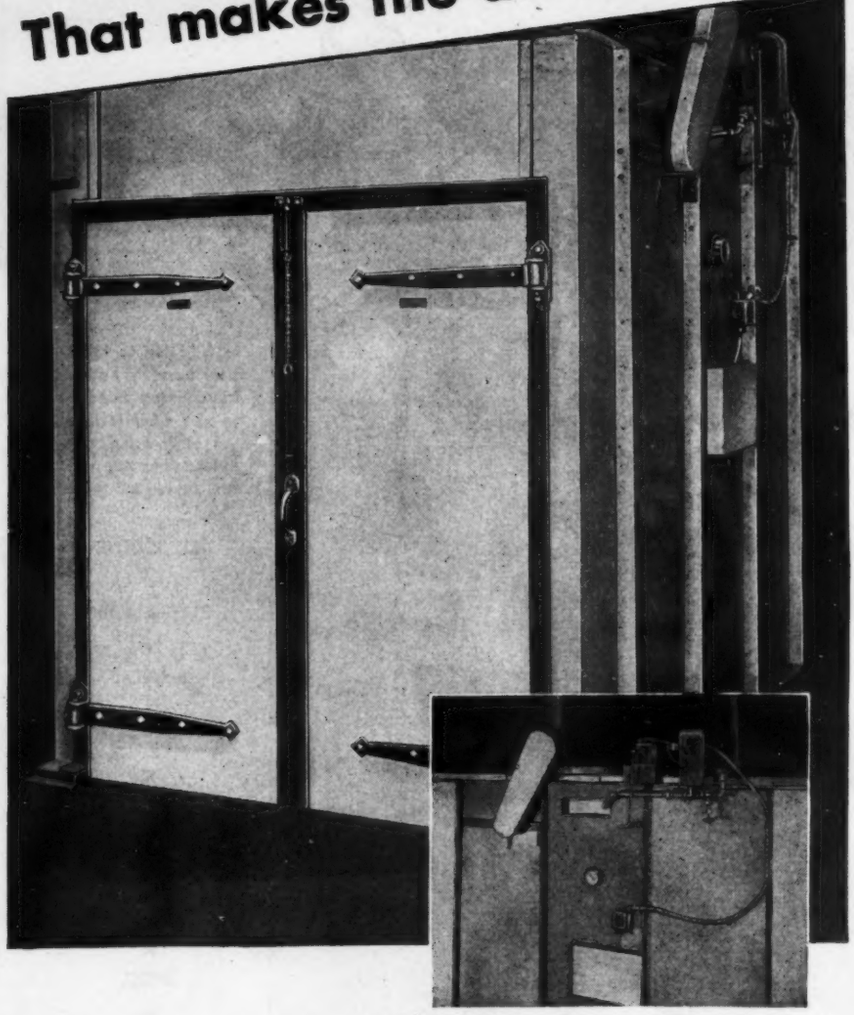
Weatherhead

THE WEATHERHEAD COMPANY, CLEVELAND 8, OHIO
Plants: Cleveland, Columbia City, Ind., Los Angeles
Canada — St. Thomas, Ontario

New uses are being found daily for the application of our *improved* industrial hose lines on machinery of all kinds. We manufacture hose assemblies of all types to withstand pressures up to 10,000 P.S.I. They can be equipped with either permanent crimped ends or with re-usable, quick-attachable hose ends. For information or literature write or phone any Weatherhead branch office.

BRANCH OFFICES: NEW YORK • PHILADELPHIA • DETROIT • CHICAGO • ST. LOUIS • LOS ANGELES

It's "KNOWING HOW" That makes the difference



● Note the special features in this Goergen-Mackwirth Brick Drying Oven:

- . . . Doors Strongly Reinforced Internally—Prevents sagging or warping with use. Extra long hinges are sufficiently strong to carry the weight.
- . . . Unit Panels—Permit oven to be easily taken down, moved, stored or re-erected elsewhere. Each panel is complete in itself.
- . . . All Parts Readily Accessible from either the top or inside of oven.
- . . . Standing Seams—for maximum structural side-wall strength.

Goergen-Mackwirth are specialists in the movement and control of air. Leading industries call on their engineering knowledge and experience when installing Ventilating Systems, Exhaust Systems, Dryers, Paint Spray Booths, Air Conditioning Systems and similar equipment. Send us YOUR problem and we'll work out the best way to solve it.

Goergen-Mackwirth
COMPANY, INC.
813 SYCAMORE STREET, BUFFALO 12, N. Y.

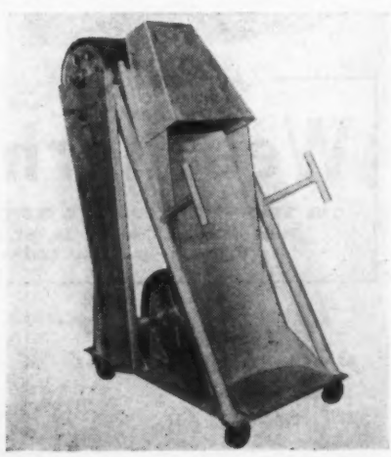
device. Model GB-200 is for long-period operations where the concentration of dust is not so heavy. Type GB-55 is fitted with respirator that is adaptable for paint spray and general nuisance dusts, and GB-1 has a chemical cartridge type respirator for absorption of fumes given off in spraying lacquers and enamels. Industrial Products Co., 2820 North 4 St., Philadelphia 33.

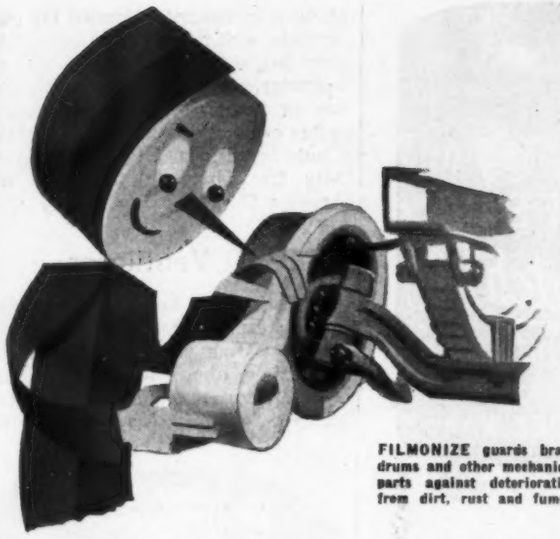
Molded Silicone Parts

Molded products made of Dow Corning silicone rubber, which is known as Silastic, are now available in the form of gaskets, seals, hose, rubber-to-metal adhesion, and miscellaneous pieces. These products are said to have extreme heat resistance, and to withstand temperatures from minus 70 deg. F. to plus 500 deg. F. and still retain their resiliency and flexibility. The Connecticut Hard Rubber Co., New Haven, Conn.

Bag Dumper

Operating on a ½-hp. electric motor, the Ritchie bag dumper lifts and empties bags of grain, cement, ore, powdered glue, dry chemicals, or other materials in bags up to 350 pounds. Mechanism eliminates hand lifting and fatigue, prevents accidents, stops waste from spilling, reduces dust, can be wheeled about as needed, and may be operated by a boy, according to the manufacturer. Automatic shutoff switch stops motor at top and bottom positions of lift. Clutch arrangement disengages motor if downward return of

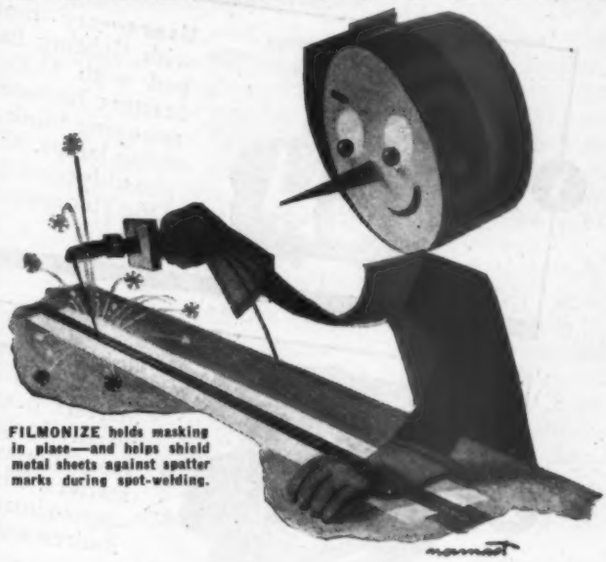




FILMONIZE guards brake drums and other mechanical parts against deterioration from dirt, rust and fumes.

FILMONIZE withstands hot temperatures. Use it to protect propeller surfaces while screws are soldered.

FILMONIZE speeds buffing—assures a neater job. Just tape the end of one surface while buffing the other.



FILMONIZE holds masking in place—and helps shield metal sheets against spatter marks during spot-welding.

Tape...your most versatile worker

FILMONIZE Tapes do so many important things for so many important industries—that we can't begin to tell you about them all.

But we can tell you that FILMONIZE saves time and money wherever it's used.

Try FILMONIZE on troublesome, time-consuming operations in your plant. Or, better yet, send for our Tape Engineer—whose business it is to show you how to use tape most efficiently—and to design special tapes for particularly intricate jobs.

Meantime, your local distributor will show you the FILMONIZE line: Transparent Tapes, Colored and Multi-Colored Tapes, Printed Tapes, Riveting Tapes, Identifying Tapes, Splicing Tapes, Acetate Fibre Tapes, Metal Tapes, Specialty Tapes, Packaging Tapes. Widths of ½" to 18" throughout.

Filmonize

TRADE-MARK REG.

SELF-SEALING TAPES

INTERNATIONAL PLASTIC CORPORATION

Morristown New Jersey

Why these three prefer G-E

Users of fluorescent lighting, engineers and maintenance men are enjoying more efficient lighting by using G-E Watch Dog Starters. These manual reset starters are providing the utmost in all-around fluorescent lighting service in war factories all over the nation. That's why these three prefer G-E.

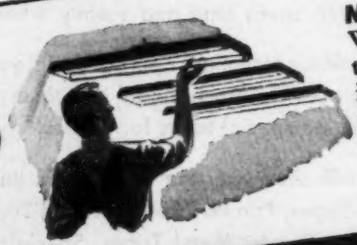
1

Users—are more satisfied with lighting fixtures equipped with G-E Watch Dog Starters because they banish annoying blink and flicker of dying lamps. Blinking cannot possibly recur once the Watch Dog Fluorescent Starters lock out.

2

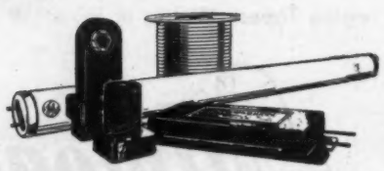
Lighting Engineers—specify G-E Watch Dog Fluorescent Starters because of their unusually long life. The Watch Dog outlasts five ordinary starters. This is equivalent to approximately three years of fluorescent lighting service.

3



Maintenance Men—like G-E Watch Dog Starters because they reduce fluorescent lighting maintenance to the simple job of pressing a red button before relamping. Reset it . . . forget it.

Would you like to know more about G-E Watch Dog Starters? Write for our bulletin, "How to Use Fluorescent Accessories for Best Lighting Results." Send your request to Section G1054-37, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.



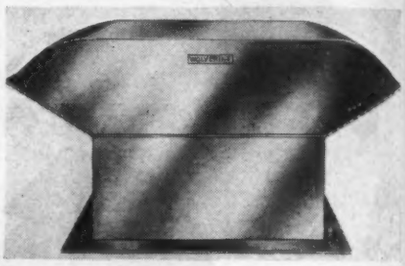
LAMPHOLDERS • STARTERS • BALLAST • LAMPS • WIRE

GENERAL ELECTRIC

chute is obstructed. Upward lift takes 10 seconds, with 8 seconds to lower. Adjustable height chute at front fits narrow openings and funnels bags' contents into vat or machine without spilling. Two spikes catch and hold bag while dumping. Chute handles bag 24 inches wide. ASCO Mfg. Co., 601 South Anderson St., Los Angeles 23.

Ventilator

Ventilating unit, known as Wolverine roof fan, is claimed to incur low installation and operating expense, to have positive ventilation results regardless of direction of wind currents, and to be adaptable to all types of roofs. Made in sizes from 30



to 60 inches, with capacities from 5650 to 45,275 c.f.m. Installation entails fastening over roof opening and connecting electrically, and can be made on roofs with angles up to 45 degrees. Belanger Fan & Blower Co., 1243 Eighteenth St., Detroit 16.

Respirator

Chemical cartridge respirator is designed for protection against low concentrations of organic vapors. Approved by the U. S. Bureau of Mines under Schedule 23, it is said to provide protection against vapors in concentrations up to 1000 parts per million of such substances as acetone, alcohol, benzene, carbon tetrachloride, ether, formaldehyde, gasoline and petroleum distillates, and toluene. Has floating-cushion flexible facepiece with soft rolled edge. Fits persons of varying facial shapes and sizes. Strap provides automatic adjustment of facepiece across nose. Equipped with twin replaceable all-metal filter cartridges and guarded exhalation valve which provides low resistance to exhalation. Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh 8.

Welder Idling Device

Said to save gasoline and prolong engine life of gas-engine-driven arc welders, a mercury-type idling device automatically shuts down the engine to idling speed 12 to 15 seconds after operator has stopped welding. To bring the engine to normal welding speed, the operator strikes an arc. The device and governor are linked with the throttle to enable device to close throttle without having to resist the governor action. When welding, the governor controls engine speed without interference from idling device, which can be made inoperative by opening toggle switch without affecting the welder or gasoline engine

a Handful of AIR POWER for Die Grinders..

POWERFUL, lightweight, pneumatic die grinders that fit well into the skilled hands of die makers become tools of concentrated energy for all-day runs.

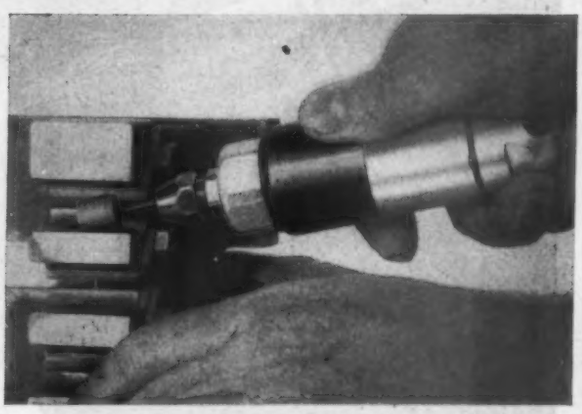
When power is combined with speed and easy handling, the die grinder also becomes an endurance tool that gives precision performance on the rough, tough production jobs such as those encountered in burring, polishing, or removal of fins from castings.

These tool-worthy characteristics of power and speed mark the Keller Pneumatic Die Grinder line. Powered by the Keller rotary vane type motor, this die grinder is available in speeds of 12,000 and 25,000 rpm and models suitable for use with mounted or unmounted grinding wheels up to 1¼" diameter. When equipped with collet or chuck, the Keller die grinder is an ideal tool for precision drilling of small holes in wood, plastics, and soft metals.

Keller Pneumatic Tools
...they do the job!

The entire Keller Pneumatic Tool line is engineered to meet the needs of modern industry. Light weight, low air consumption, and low maintenance costs, even in round-the-clock service, add to the line's popularity with skilled operators and with management.

Keller Tool Company
4510 Martin Street Grand Haven, Michigan



KELLER
Pneumatic Tools

"Take it away" with

CM HERC-ALLOY

SLING CHAIN

Every Inswell electric-welded link in this CM Herc-Alloy steel chain personifies safety and lifting strength. From the white hot ingots in the nation's steel mills to the finished structural girders for our skyscrapers, CM Herc-Alloy Sling Chains have been doing a handling job that ranks them "tops" in industry... "tops" in dollar value, service life, maximum safety or any other yardstick of measuring.

Ask your mill supply distributor about the particular CM Herc-Alloy Sling Chain for your job and learn first hand the reasons why the top names in American industry have been using them for years.

HERC-ALLOY LINK SHOWING PATENTED INSWELL WELD

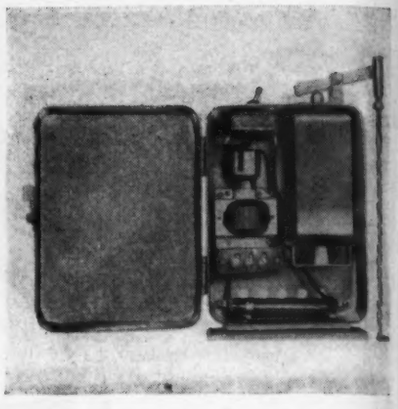
COLUMBUS-McKINNON

CHAIN CORPORATION

(Affiliated with Chisholm-Moore Hoist Corporation)

GENERAL OFFICES AND FACTORIES: 130 Fremont Ave., TONAWANDA, N. Y.

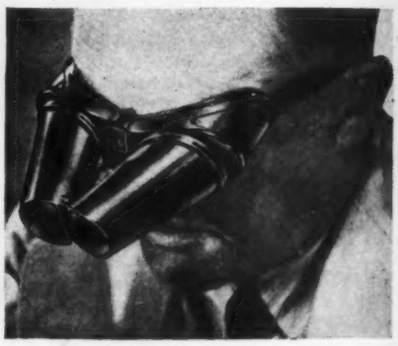
SALES OFFICES: New York, Chicago and Cleveland



operating characteristics. Switch is enclosed in a stainless steel case, sealed under pressure to prevent entrance of dirt and moisture. The Hobart Bros. Co., Troy 1, Ohio.

Magnifying Glasses

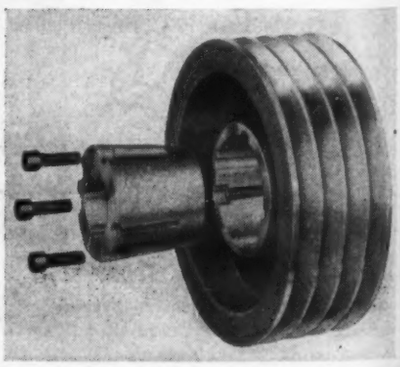
Plastic Berger loupe, for occupations involving close work, is presented. Possesses lightweight frame with adjustable elastic headband. Adjustable for different facial contours and widths between eyes, the



loupe fits any type of face, can be worn over glasses, and is ventilated. Precision-ground lenses give a magnification of 2.5X. American Optical Co., Southbridge, Mass.

V-Belt Sheave

The Taperlock V-belt sheave is installed by slipping sheave and bushing assembly on shaft and tightening two or three locking screws, according to size of sheave. Screws are in threaded engagement with sheave hub and free in the bushing groove. As screws are tightened, they push against tapered bushing forcing it in tapered bored hub, causing bushing to con-



HOW INSULATION USERS SAVE TIME, WORK and MONEY with New PLANT-Pioneered..

for 85% Magnesia and High Temperature Pipe Coverings

Faster Application! Because the outside diameter of each size of pipe covering now is made to fit exactly inside another standard pipe covering size! Sectional sizes up to and including 18-inch pipe size!

Less Delay on Odd Thicknesses! Now they can be readily assembled from prime sizes!

Less Stock to Carry! Service every insulation need in your plant with just prime sizes! No odd left-overs, either—every piece is standard, readily usable material!

Better Service From Your Distributor! 48 per cent fewer items for him to handle! He now can order prime sizes from us in Solid or Broken-Joint construction. He can specify shipment of large lots direct to your job . . . meet emergency special requirements by assembling them in his own warehouse!

Write Today for new, handy "Digest of Simplified Thickness Standards."

Another Great "FIRST" by the makers of

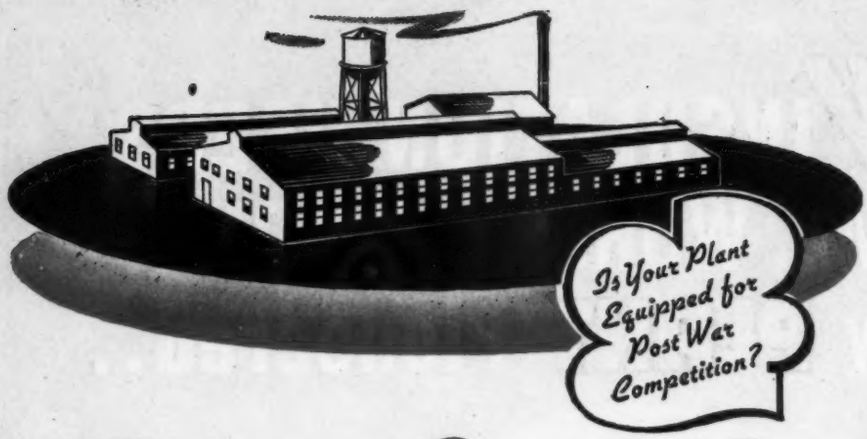
REG. U. S. PAT. OFF.

PLANT RUBBER & ASBESTOS WORKS

GENERAL OFFICES: SAN FRANCISCO • PLANT Engineering Service Units in Principal Cities • FACTORIES: Emeryville, San Francisco, and Redwood City, Calif.

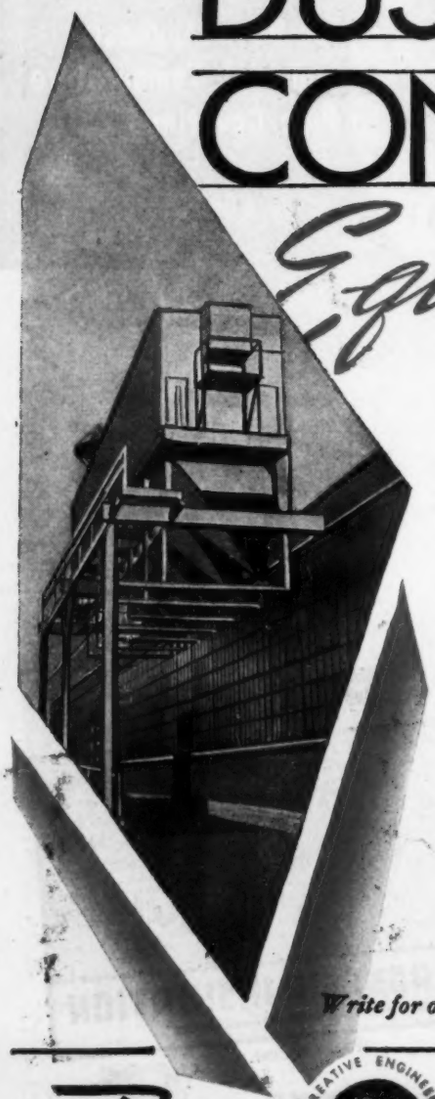
Army-Navy "E" Awarded to FACTORY No. 2 Emeryville, Calif.

Manufacturers of Plant Insulating Materials and Mechanical Packings. Established 1890. *U. S. Patents Nos. 2,111,374, 2,209,752, 2,209,753, 2,209,754.



Parsons Oval Bag

DUST CONTROL Equipment



- SPEEDS UP PRODUCTION
- REDUCES MAINTENANCE
- INCREASES EFFICIENCY

To meet the keen competition of the post war period, far sighted executives are streamlining their factories for greater, more efficient production. Number one on their list is dirt and dust control. The answer is Parsons Oval Bag dust arrestors, backed by over 25 years of creative engineering and experience gained from installations everywhere. Dirt and dust are a menace to employees—slow down production . . . and deteriorate equipment. You can reclaim valuable dust, increase your production and employee efficiency with Parsons Oval Bag dust arrestors . . . our engineers will check your dust problem without obligation.

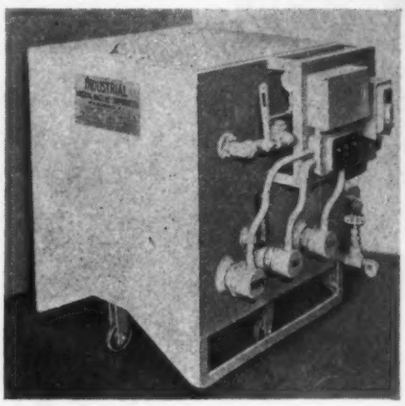
Write for our Bulletin . . . "Mastery of the Air"

Parsons CREATIVE ENGINEERS MANUFACTURERS ENGINEERING CORP.
2545 EAST 79th ST, CLEVELAND 4, OHIO

tract and wedge between hub and shaft on which it is installed. Construction provides a mounting of minimum dimensions for accommodation of the screws and their connection with hub and bushing. Permits use of flangeless bushing, and eliminates extension of either hub or bushing, or any collars or protruding parts, reducing weight and facilitating mounting and demounting. Wedging action gives equivalent of a shrunk-on fit on shaft. Dodge Mfg. Corp., Mishawaka, Ind.

Portable Washing Machine

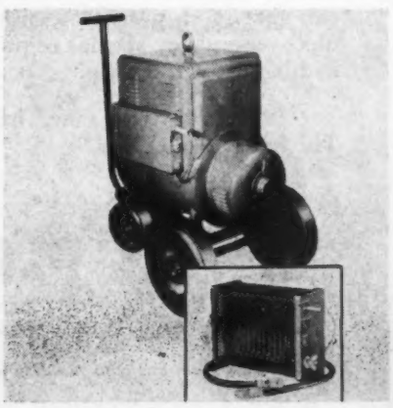
Model CBH industrial washing machine consists of tank and housing, and is portable. Electric immersion heaters, pump and motor, valves, switches, and gages are mounted on housing. Parts to be cleaned are placed in a square mesh basket, 16x16 inches, cover is lowered, and spray valve



turned. Force of spray causes basket to rotate so that all the material is cleaned. Basket can be removed and machine converted into a tank for wax or oil dipping of parts. Unit is designed to prevent detergents from coming in contact with operators' hands. It can be used for cleaning stampings, ball bearings, castings, pans, and other small parts. Industrial Washing Machine Corp., New Brunswick, N. J.

Welding Attachment

Three-step Thinweld attachment for arc welding machines is claimed to make it possible to weld from 10 amperes up through maximum rating of the machine without any dead spots. Suitable for use where the work may vary from heavy to light gages. The No. 413 attachment is

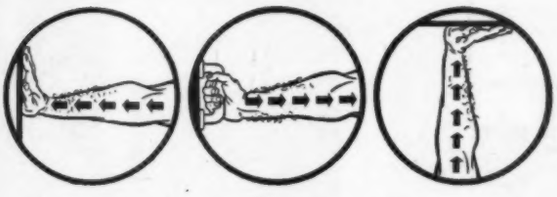


MORE SPEED...LESS COST WITH

for TOUGH JOBS!

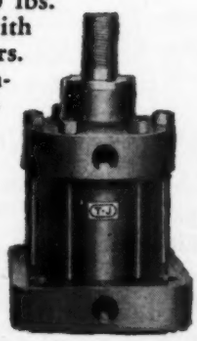
T-J CYLINDERS

Simplify — POWER MOVEMENT



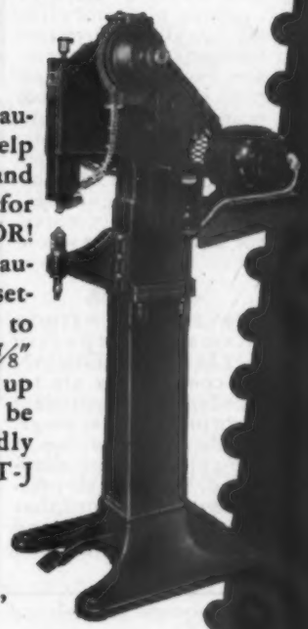
FOR PUSH-PULL-LIFT JOBS... 100 LBS. OR 50,000 LBS.

Apply a T-J Cylinder to eliminate muscular effort or to simplify mechanical movements—the ideal way to clamp, press, raise or shift in any direction. T-J Engineered and built in many styles, sizes and strokes to meet your requirements... exerting power movement of 100 lbs. to 12,000 lbs. (direct) with T-J Air Cylinders... 1,000 lbs. to 50,000 lbs. (direct) with T-J Hydraulic Cylinders. Easily and quickly installed. Write for latest catalog.



T-J RIVITOR

Sets 'em fast



Here's speedy, efficient, automatic-feed riveting to help you increase production and cut costs—the machine for the job is the T-J RIVITOR! Electrically powered for automatically feeding and setting solid steel rivets 1/16" to 1/4" dia. incl., and up to 7/8" incl. long. Work requiring up to 36" throat depths can be accommodated. Ruggedly built... designed with T-J know-how based on 28 years experience ...Write for bulletin. The Tomkins-Johnson Co., Jackson, Mich.

FOR AUTOMOBILES... STOVES... FARM MACHINERY... KITCHEN UTENSILS... TOYS...LAWN MOWERS...STAMPINGS... REFRIGERATORS...WASHING MACHINES... HARDWARE ITEMS... AND MANY OTHER USES...

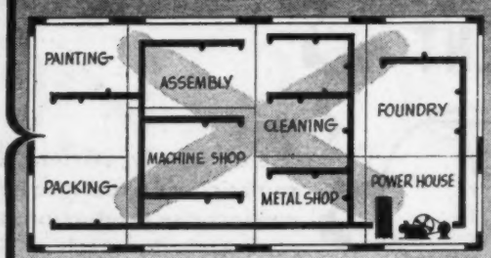
TOMKINS-JOHNSON

RIVITORS...AIR AND HYDRAULIC CYLINDERS...CUTTERS...CLINCHORS

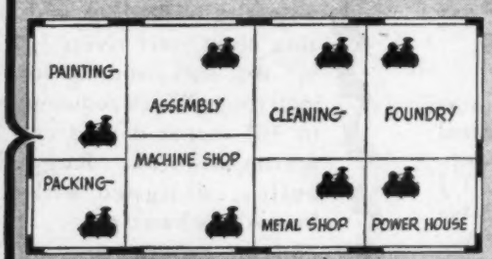
T-J

28 YEARS EXPERIENCE

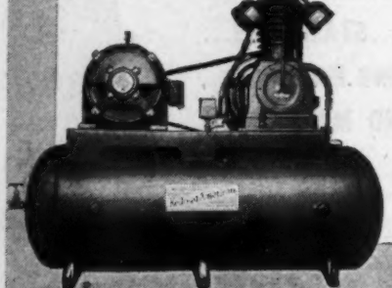
OLD *WASTEFUL* METHOD . . . long pipelines carry air to all departments from one large compressor. Every air outlet and pipe joint is a possible point of leakage. Resultant air losses can slow down production, may double the cost of maintaining working air pressure. If a large compressor should fail, the whole plant may shut down.



NEW *EFFICIENT* METHOD ...smaller capacity KELLOGG-AMERICAN air compressors are located in each department right on the spot of usage. Costly air losses due to long pipelines are eliminated. Working air pressures are maintained, thus assuring efficiency and economy in every department.



Adequate air volume at the right pressure. Wherever, whenever you need it. *Without noise* and *vibration.* That is KELLOGG-AMERICAN "On-the-Spot" air. For whisper-quietness and vibration-free operation are built into KELLOGG-AMERICAN air compressors. Compression efficiency is high. Operating and maintenance costs are low. Chances are, your present pipeline losses will more than pay for efficient KELLOGG-AMERICAN "On-the-Spot" air. Consult your nearest Kellogg-American Distributor or write direct for further information.



KELLOGG DIVISION
ROCHESTER 9, N. Y.

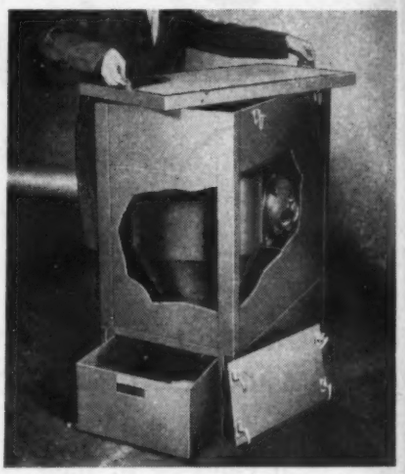
AMERICAN **Brake Shoe** COMPANY

AIR COMPRESSORS · PAINT SPRAY EQUIPMENT

furnished with a 3-ft. cable, which is connected to ground terminal of welding machine and ground lead is connected in turn to wing nut on the device. By plugging the jack into three alternative positions—low, medium, or high—it is possible to get three additional ranges of amperage. Intermediate points can be obtained by use of field rheostat. Current values obtainable in each of the sub-ranges are low, 10-20 amperes; medium, 15-30 amperes; high, 25- up to minimum capacity of standard welding machines. The Hobart Bros. Co., Troy 1, Ohio.

Dust Remover

Designed for individual use on large wheel dry grinders, disk grinders, sanders, and polishing and buffing equipment, Model 1150 Dustkop dust collector also is adaptable for use on more than two wheels when they are small and grouped close together. It has a thick flat filter of spun glass. Of the unit type, no ductwork is required for its installation. Connection between dust outlets and collector can be completed with flexible metal hose or standard sheet metal pipe. Air is cleaned and recirculated back into the working space to save heat and prevent drafts. Available with motors for operation on different types of power, and can be supplied with inlet sleeves for connections of various sizes to one or more dust sources. Aget-Detroit Co., 602 First National Bldg., Ann Arbor, Mich.



Water Treating Solution

Chemical development is said to have lime solubilizing, fungistatic, and detergent properties to inhibit slime growth and control formation of lime scale deposits in evaporative condensers and coolers. The material is a soluble white powder, odorless and non-toxic. Oakite Products, Inc., 14A Thames St., New York 6.

Pressure Lock Wrench

Plier wrench operated with one hand is said to pack more than a ton of gripping power between its steel jaws and lock it there. Less than 8 inches long and 12 ounces in weight, it can be carried in pocket or on belt. Made of heat-treated

You're in good company . . .

in *Southern New England*

No matter where you go in industrial Southern New England, it won't be long before you come upon the plant of a well-known manufacturer.

For example, in this section of Connecticut, nationally-famous typewriters, locks, firearms, silverware, brushes, tools, safety razors, rugs, vacuum bottles, aviation engines and propellers, rubber goods, shaving cream, soap and skin lotion, as well as many other products, are manufactured.

Every one of these products has a name as familiar as your own. Many of them had their beginnings here. Others have come because of conditions favorable to manufacturing . . . generations of skilled craftsmen; abundant power; fair taxes; industrially-minded banking; State and local government that grew up with industry and understands its problems.

But that is only part of the story.

Southern New England lies in the heart of the world's richest, most-highly concentrated market.

Within a radius of 500 miles live 58,000,000 people to absorb not only Southern New England's consumers' goods but her producers' commodities —the tools and parts that go into other industries.

And because no part of Southern New England is more than 125 miles from tidewater and the great ports leading to foreign markets, manufacturers locating here will be at the threshold of the huge overseas trade that will develop during the great era of peacetime commerce ahead.

Southern New England offers better personal living, too, for it abounds in charming residential communities with good schools, churches, lakes, hills and sandy beaches—all close by.

In planning your tomorrow, don't overlook Southern New England—perfect for your new or expanding business . . . and for your all-around enjoyment of life.

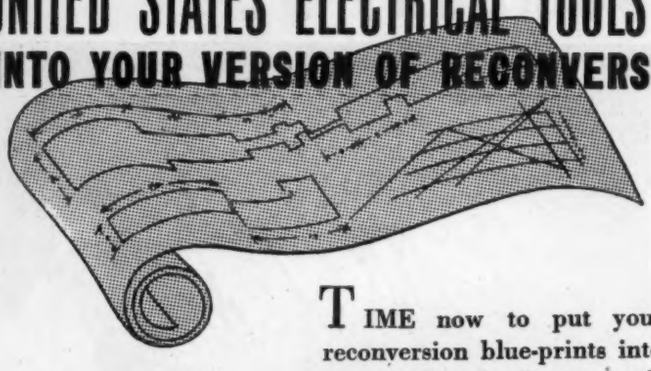
An industrial booklet in full color, "Southern New England for Tomorrow's Industry", is yours for the asking. Write to P. E. Benjamin, Manager of Industrial Development, The New Haven Railroad, 80 Federal Street, Boston 10, Mass.

This is one of a series of advertisements presenting the industrial advantages of Southern New England.

THE NEW HAVEN R.R.

Serving **SOUTHERN NEW ENGLAND** *with a network of rail and highway transportation that puts every manufacturer* "ON THE MAIN LINE".

UNITED STATES ELECTRICAL TOOLS
FIT INTO YOUR VERSION OF RECONVERSION



TIME now to put your reconversion blue-prints into action! For the former rush to convert to war work probably will be equalled by the eagerness to get back to civilian production.

To make your reconversion program show up on the profit side you'll need UNITED STATES ELECTRICAL TOOLS to speed production and keep costs in line.

HEAVY DUTY DRILLS

Model 58HD ⅝"
Model 34HD ¾"

Super-powered, especially designed for heavy production work or maintenance. Ball bearings on armature. Chuck spindle mounted in two radial thrust ball bearings. Chrome nickel steel gears, heat treated, packed in grease and sealed. Two pole quick make and break trigger switch. Momentary switch, if desired.

Model 34 HD can be furnished with No. 2 or 3 Morse Taper Socket without additional charge.

THE United States ELECTRICAL TOOL CO.
CINCINNATI 14, OHIO

PORTABLE ELECTRIC GRINDERS

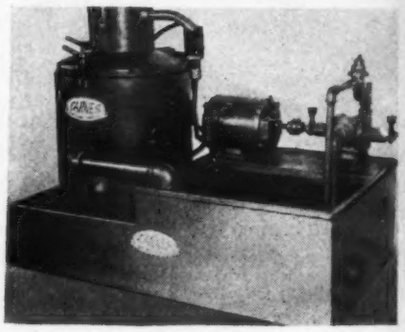
4" to 8 —from 1/3 h.p. to 1 h.p.

For grinding, buffing, polishing, sanding down castings and other operations. For production or maintenance. Chrome nickel alloy steel gears, hardened, in grease-tight case. Oversize ball bearings throughout. Universal motor.

steel with molded section of red Tenite plastic in handle. Suitable as adjustable pipe or end wrench, locking clamp, straight-duty or ratchet-action pliers, toggle clamp, and gripping tool for handling awkward materials. Calibrated scale and indicator show width of jaw opening (¾ inch maximum). Adjusting nut is operated by thumb and finger of hand holding the tool. Steel jaws are parallel at any opening to provide maximum gripping surface. Botnick Motor Corp., Binghamton, N. Y.

Clarifier

Centrifugal extraction of chips, sludge, and other solid contamination, from oil in machine tools is the function of Model G-A clarifier. In passing through clarifier, the coolant or oil is aerated, retarding rancidity, and keeping oil or coolant free from disagreeable odors, manufacturer says. Clari-



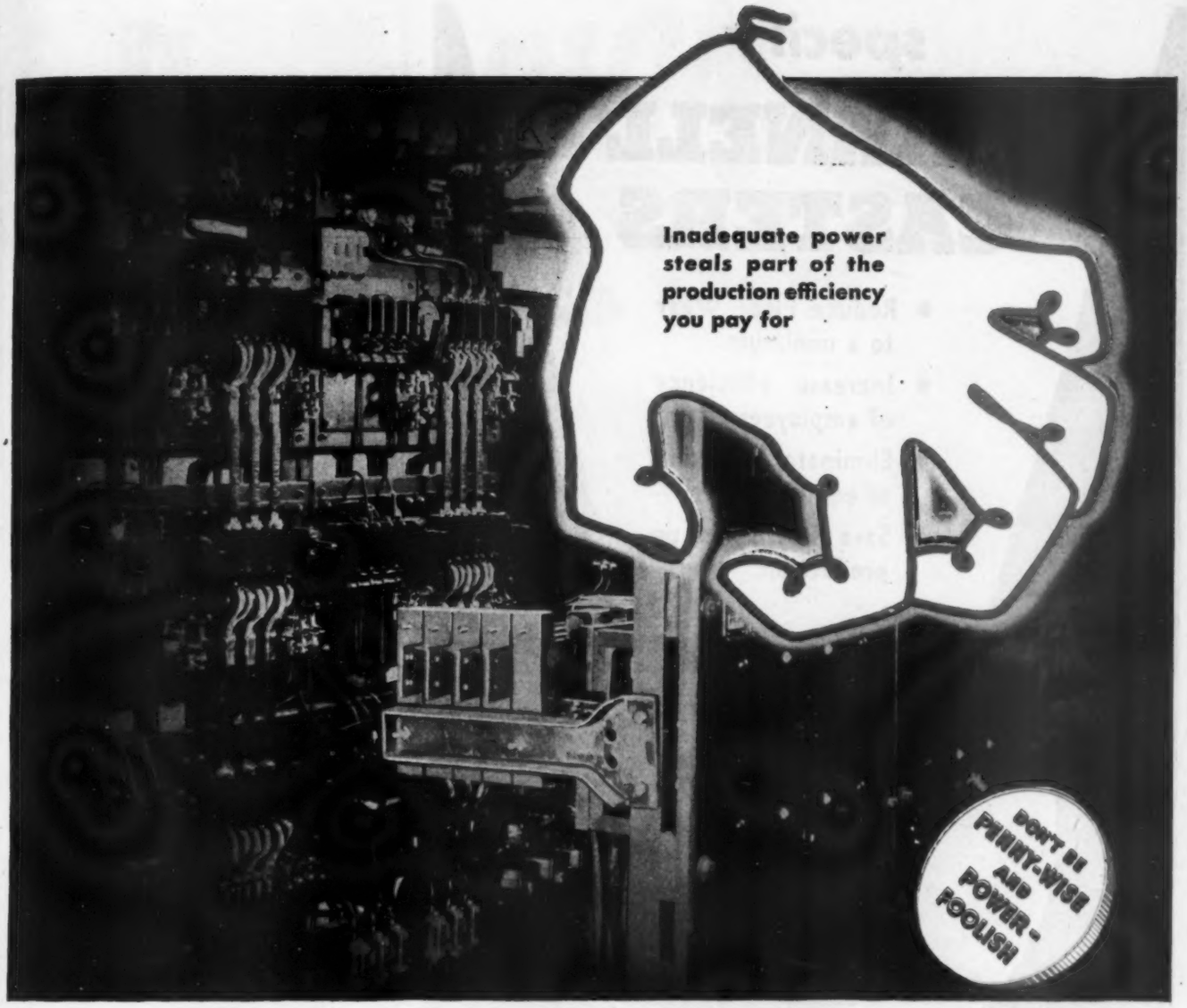
fier handles up to 30 gallons of oil or coolant per minute. By selecting the type of filter bag to suit the application, and adjusting speed of centrifuge, any type of oil or coolant can be clarified. It is said that equipment needs to be cleaned only when 30 to 50 pounds of sludge, chips, and dirt have accumulated. W. R. Carnes Co., Madison 4, Wis.

Goggle Cleaning Compound

Anti-fog preparation, for keeping goggle lenses, face shields, and welding plates clear, is presented. The material deposits a thin film which is said to help prevent fogging, steaming, and frosting of glass surfaces, as well as to remove grease and dirt. American Optical Co., Southbridge, Mass.

Truck Lift

Packing, loading, lifting, and transporting loads are functions of new model of the Mobilift truck lift. Compact proportions,



Backward wiring handicaps advanced equipment

...Wire ahead

DON'T HOBBLE new, improved equipment for the sake of saving a few extra dollars worth of wiring.

Remember, to get peak efficiency from postwar production equipment wiring must come first—foresighted wiring to provide for greatly expanded power needs to come.

Check your wiring plans now. Avoid costly alteration shutdowns later. Call in your consulting or plant power engineer, electrical contractor or power salesman. Hear what *they* say about the wisdom of soundly planned wiring and service equipment. Anaconda Wire & Cable Company, Subsidiary of Anaconda Copper Mining Company. General Offices: 25 Broadway, New York City 4. Chicago Office: 20 North Wacker Drive 6. Sales Offices in Principal Cities.

✓ *Check your wiring plans before they check you!*

HELP BRING VICTORY SOONER
...BUY MORE WAR BONDS

ANACONDA WIRE & CABLE COMPANY

specify

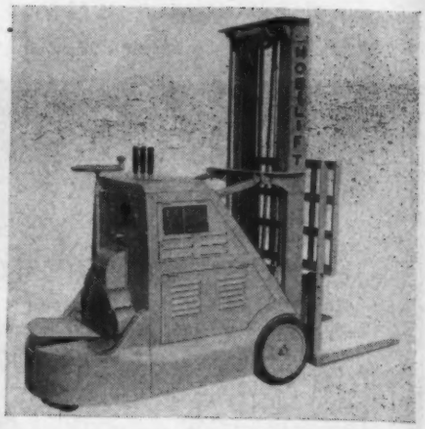
DARNELL CASTERS

- Reduce Floor Wear to a minimum.
- Increase efficiency of employees.
- Eliminate wracking of equipment.
- Save time, speed up production.

A SAVING AT EVERY TURN

DARNELL CORP. LTD.
LONG BEACH 4, CALIFORNIA

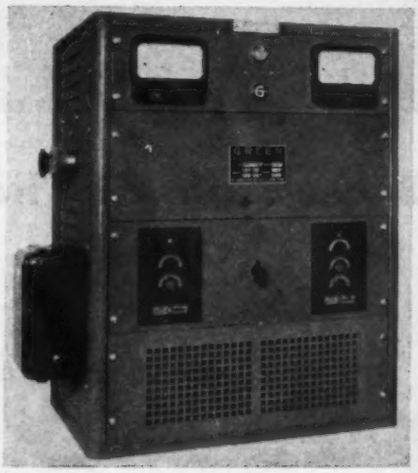
60 WALKER ST., NEW YORK 13, N.Y.
36 N. CLINTON, CHICAGO 6, ILL.



short turning radius, and multiple disk clutches, enabling operator to drive forward or backward by action of a single lever, are said to increase maneuverability. Motor is equipped with a 2-cyl. air-cooled engine. Truck operates on ramps graded from 10 to 20 percent. Has a telescopic lift mechanism operated by two sets of roller chains with ultimate strength of 8500 pounds each. Operator stands on platform for visibility and freedom of action, and is protected from moving parts by frame construction. The Vaughn Motor Co., 835 Southeast Main St., Portland, Ore.

Low Voltage Rectifiers

Stabilized rectifiers with low voltage high current output are now on the market. Unit rated at 200 amperes has voltage range zero to 3 volts. Any voltage selected in range is said to be maintained to within



50 millivolts over load variation from zero to 200 amperes, and with line voltage variation of plus or minus 10 percent. Voltage stabilization system includes motor-driven Powerstat and simple electronic pilot device. Principle is applicable to larger or smaller rectifier units. Green Electric Co., 130 Cedar St., New York.

Hammer Face

A recently developed material is now available for Basa soft-face hammers. Material is said not to chip or mar surface it strikes, not to be affected by solvents, to be non-flammable and non-explosive,

PRECISION PROGRESS

When the chips were down and the manufacture of precision parts was essential to the prosecution of the war, our large force of engineers and craftsmen developed and produced a myriad of aircraft engine parts. In the world of tomorrow when the production of quality duplicate parts can mean your progress, Lawson Precision manufacture will accelerate and help achieve your goal.

Torque Indicator Connecting Rod manufactured for Pratt & Whitney aircraft engines.

PRECISION Lawson

ARMY E NAVY

LAWSON MACHINE and TOOL CO.

120 MOUNTAIN AVENUE, MALDEN 48, MASS.

SCHRAMM OFFERS THESE *Exclusive* COMPRESSOR-ECONOMY FEATURES

Four features make Schramm Air Compressors ideal for industry. They are: (1) 100% water cooled (2) compact—lightweight. (3) mechanical intake valve (4) forced feed lubrication. These features enable you to do your job quickly, easily, economically.

Schramm Compressors are designed for heavy duty, continuous service, with minimum attention. They are built in sizes ranging from 20 to 600 cu. ft. displacement, in every type of mounting and assembly.

Other Schramm features include long life discharge valve, and smooth, vibrationless operation. Make your compressed air job *easier* by using Schramm. Write today for details in FREE booklet just published.

SCHRAMM INC.

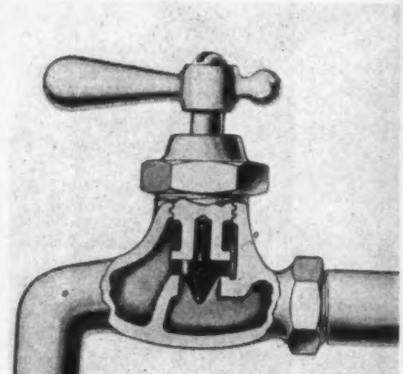
THE COMPRESSOR PEOPLE • WEST CHESTER • PENNSYLVANIA

This Stands for Honorable Service to Our Country

and not to mushroom, shrink, expand, or come apart. Lack of rebound tends to reduce worker fatigue. Faces can be used until worn down to head of hammer, after which they can be replaced by loosening a nut. Greene, Tweed & Co., 4377 Bronx Blvd., New York 66.

Faucet Washer

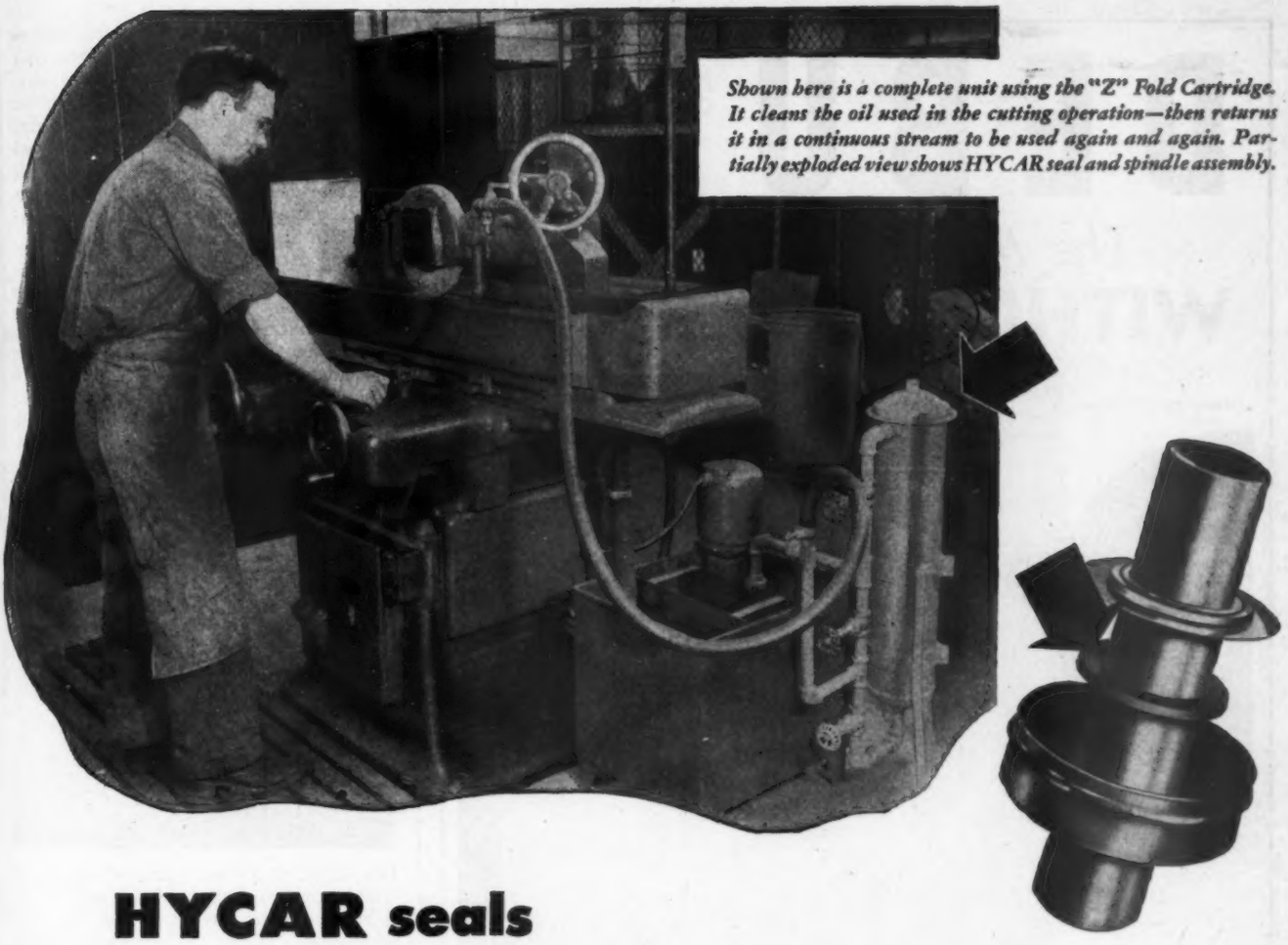
Dumaco washer is for repairing leaky, noisy faucets. Needs no tools to install. It has rotating disk action, and is said to



eliminate pipe vibration. Available in three sizes. Durst Mfg. Co., Inc., 462 Broadway, New York 13.

Hand Truck

One-hand operation and maneuverability in close quarters are among the advantages claimed for truck, which carries loads up to 500 pounds. Truck has a double tubular lightweight frame with welded joints



Shown here is a complete unit using the "Z" Fold Cartridge. It cleans the oil used in the cutting operation—then returns it in a continuous stream to be used again and again. Partially exploded view shows HYCAR seal and spindle assembly.

HYCAR seals put filter performance "in the bag"

IF the bag-like refill cartridge in an industrial oil filter isn't properly sealed at both ends, clean and dirty oil will mix together, making the filter useless. That's why Briggs Clarifier Company engineers, after rigid test of many materials, selected HYCAR synthetic rubber for the sealing rings in the type "Z" Fold Refill Cartridge.

There were 4 performance characteristics needed in the material selected. First, it had to be resilient to slide over the spindle inside the unit—no buckling or tearing during installation of the refill cartridge. Second, it had to resist deterioration—remain unaffected by hot oils, acids, water. Third, it had to resist vulcanization to the metal spindle even at continued high temperatures. Finally, it had to *stay* resilient—maintain a perfect seal for the full long life of the refill cartridge.

That HYCAR could meet these requirements is plainly shown by the list of properties in the box at the right. They tell why HYCAR has in 5 short years become an important basic material for American industry. *Ask your supplier* for parts made from HYCAR. Learn for yourself that it's wise to use HYCAR for long-time dependable performance. *Hycar Chemical Company, Akron 8, Ohio.*

CHECK THESE SUPERIOR FEATURES OF HYCAR

1. *EXTREME OIL RESISTANCE—insuring dimensional stability of parts.*
2. *HIGH TEMPERATURE RESISTANCE—up to 250° F. dry heat; up to 300° F. hot oil.*
3. *ABRASION RESISTANCE—50% greater than natural rubber.*
4. *MINIMUM COLD FLOW—even at elevated temperatures.*
5. *LOW TEMPERATURE FLEXIBILITY—down to —65° F.*
6. *LIGHT WEIGHT—15% to 25% lighter than many other synthetic rubbers.*
7. *AGE RESISTANCE—exceptionally resistant to checking or cracking from oxidation.*
8. *HARDNESS RANGE—compounds can be varied from extremely soft to bone hard.*
9. *NON-ADHERENT TO METAL—compounds will not adhere to metals even after prolonged contact under pressure. (Metal adhesions can be readily obtained when desired.)*

Hycar

Reg. U. S. Pat. Off.

LARGEST PRIVATE PRODUCER OF BUTADIENE TYPE

Synthetic Rubbers

DEBURR

The Most Delicate Parts
WITHOUT NICKING!

Model No. 307-A

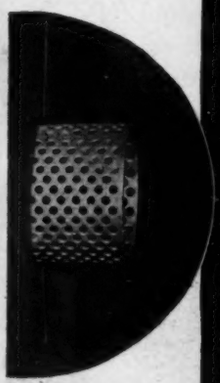
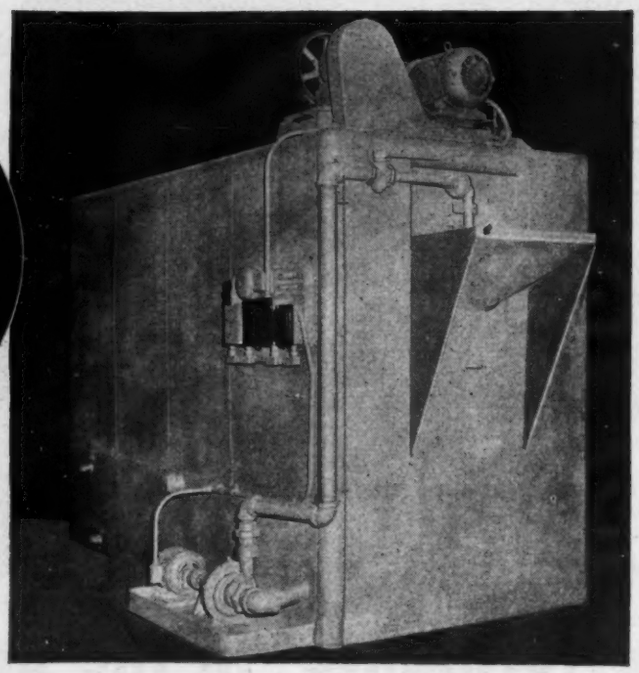


Illustration above shows discharge end of this new Howard Mill

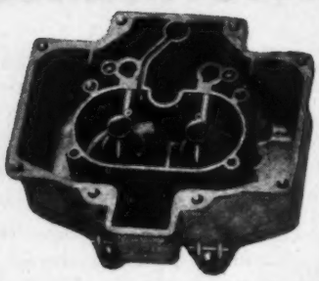


New Howard End Loading and End Discharge Wgt-Type Mill. Automatic Separation of Tumbling Media.

HOWARD
MASS PRODUCTION
Deburring Machine

New and different, this Howard Mill permits mass production deburring with utmost uniformity and precision. Delicate parts, regardless of size and intricacy will not get any nicking. Large quantities of parts can be processed in the time formerly required to finish one or two by hand. We'll be glad to prove it. Send us sample parts for processing without charge or obligation.

Representatives in Principal Cities



Burrs and other irregularities on compound surfaces and recessed areas of this carburetor die casting are completely removed WITHOUT NICKING!

WRITE FOR CATALOG and FURTHER DETAILS

HOWARD

HOWARD ENGINEERING & MFG. CO.

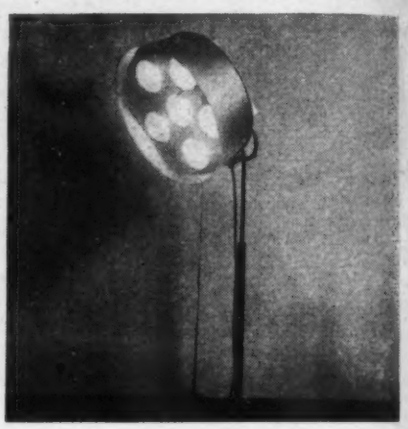
2242 Buck St. Cincinnati 14, Ohio

MACHINERY for Pickling • Tumbling • Deburring • Washing • Quenching • Drying • Burnishing

and 8x13-in. high tensile steel bottom plate. Wheels are of copper-brazed double-disk pressed steel with floating steel ball lubrication. They have hard rubber treads permanently vulcanized to the rim, which is V-shaped for alignment. Truck stands straight up when not in use. Available in several colors. Wheels may be obtained separately. Yarco Distributors, 215 West 7th St., Los Angeles 14.

Infra-Red Units

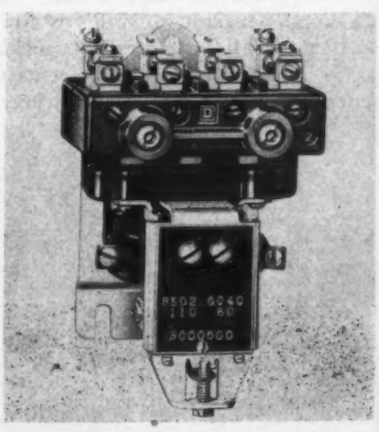
Portable infra-red units for use with reflector type (R40 or RE40) infra-red or drying lamps are announced. Model W6 is designed for 6 lamps, and model R12 for 12 lamps. Reflector type lamps in



125-, 250-, or 375-watt sizes may be used. Units can be applied where heat is required in baking, drying, evaporating, and preheating. Made of heavy-gage metal, rigidly constructed, can be used at any angle or in any position. Carbomatic Corp., 117 West 63 St., New York 23.

Contactor

Convertible contacts that can be changed from normally open to normally closed without additional parts are featured in size 00 contactors. Conversion is effected by removing a movable contact assembly, inverting it, and putting it back in place. No additional parts are involved. Terminals can be individually or group mounted, and have provision for two wiring clips. Double-break silver contacts can be replaced. Contactors, known as Type Q, are suitable for mounting on steel panels, and are available with two to six poles in any combination of normally open and



Cutting through Marble like butter

★

With no slippage

★

With greater safety

★

With maintenance costs cut to a minimum!

★

Imagine cutting through marble—or limestone, or sandstone—at the rate of two to four feet a minute! It seems incredible, but this powerful 5-foot saw does it with ease.

For 10 years—since the original drive was discarded because of slippage and breakage—Dayton V-Belts have been providing trouble-free power transmission on this stone cutting job. Slippage has been eliminated. The danger of breakage has been eliminated. And maintenance costs have been reduced to a minimum.

Such highly efficient V-Belt power transmission drives are possible because of Dayton's 40 years of research and technical experience in manufacturing natural and synthetic rubber products. Your Dayton V-Belt Distributor will gladly make this research, experience, and engineering skill available to you. Take full advantage of his services. Call him today!

THE DAYTON RUBBER MANUFACTURING COMPANY
DAYTON 1 • OHIO

V-Belts by

Dayton Rubber

REG. TRADE MARK — THE DAYTON RUBBER MFG. CO.

THE MARK OF TECHNICAL EXCELLENCE IN SYNTHETIC RUBBER

THE WORLD'S LARGEST MANUFACTURER OF V-BELTS

Plan Now!

BLAW-KNOX

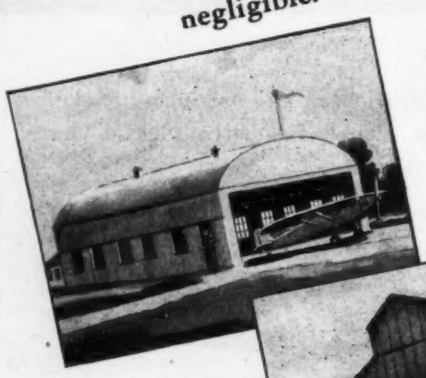
STEEL BUILDINGS

for LOW COST PER YEAR

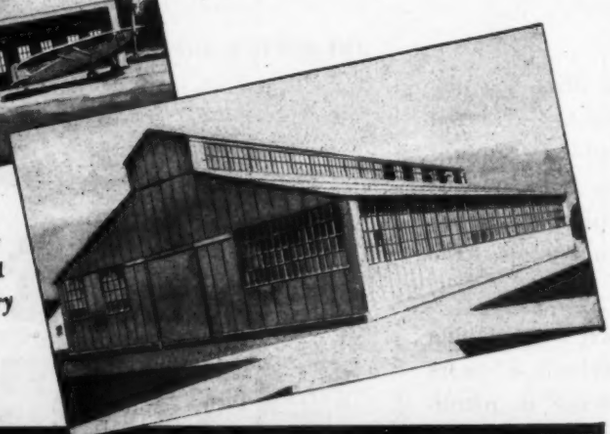
Temporary shelter and makeshift storage—necessary in war-time days—is now due for replacement.

The cost per year of such buildings includes high maintenance and repairs, inefficient production and wasted materials, accidents and discomforts to workers, and fire and weather hazards.

BLAW-KNOX permanent steel buildings provide economical shelter for both large and small plant needs. They are quickly erected. Their maintenance costs from year to year are negligible. Their service life is extremely long.



BLAW-KNOX engineers will fit BLAW-KNOX STEEL BUILDINGS to your needs.



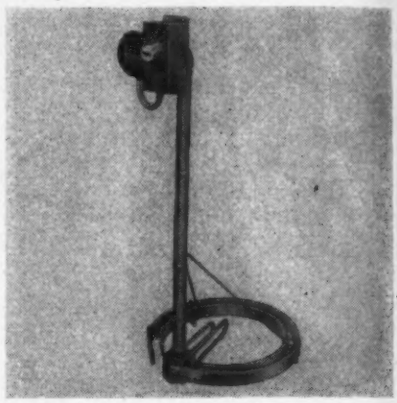
Write for Catalog No. 1791 for preliminary data.

BLAW-KNOX DIVISION
of Blaw-Knox Company
2031 Farmers Bank Building
Pittsburgh 22, Pa.

closed contacts. Ratings are 600 volts a.c. maximum; 10 amperes open, 9 amperes closed. Industrial Controller Div., Square D Co., 4041 North Richards St., Milwaukee 12.

Portable Immersion Heater

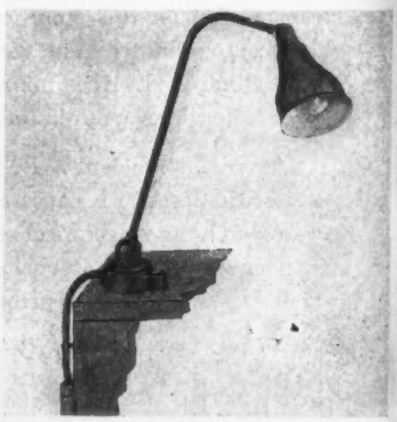
Chromalox electric immersion heater is designed for melting solid oil, greases, and similar compounds in standard 55-gal. drums and containers by allowing heater to melt its way down through contents. Steel-sheathed heating elements encircle a



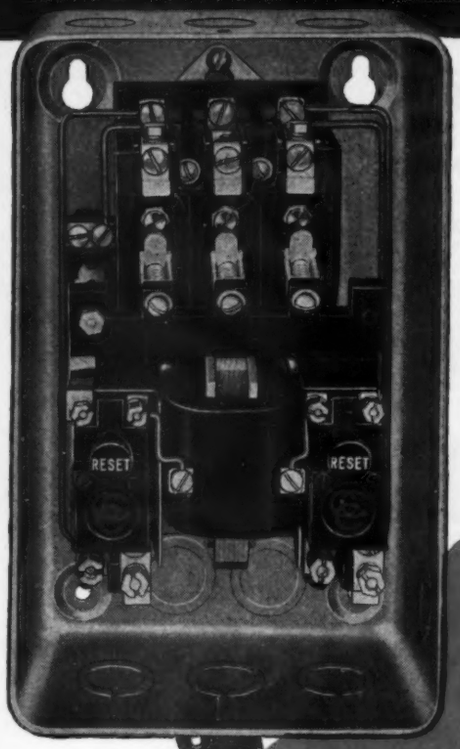
tubular unit. Steel braces are welded to steel riser through which electrical connections are brought out to a standard conduit box. Heater can be controlled by 3-heat switch or thermostat mounted directly on terminal box. Known as Type BLC, the unit is available for 115- or 230-volt single phase current in ratings up to 4400 watts. Edwin L. Wiegand Co., 7518 Thomas Blvd., Pittsburgh 8.

Work Light

For attachment to machine tools, assembly benches, and desks, Work-Lite is announced. Comes with Greenfield cable and leads, for direct attachment to outlet box or transformer, thereby grounding the unit. Available with arms from 12 to 30 inches long, in four types of shades—cone, bell, parabola, or acorn, and with or without removable frosted, clear, or daylight glass lens. Light is made with adjustable spring-construction socket which is said not to work loose from vibration. Socket has no wingnuts or setscrews to tighten and is easy to adjust, wires are completely en-



"3C" Bulletin 6013 AC MAGNETIC STARTERS *are* ENGINEERED *for* EASY MAINTENANCE



Clark Bulletin 6013 Non-Reversing Across-the-Line Starters are designed and built to provide safe motor control under heavy duty service. When maintenance is necessary, construction permits quick and easy access to all parts, minimizing "down-time" of vital machines.

Changing Contact. A twist of the fingers removes worn moving contacts and replaces new ones. The contacts are so designed that they can easily be slipped into position. Alignment is automatic. The contact pressure springs are anchored in position and will not fly out of place when the contacts are removed.

Moving Mechanism. Illustration at left shows entire moving mechanism separated from the mounting plate for major maintenance purposes. Loosening two screws which are retained in position by special spring clips does it. All moving parts are thus exposed for easy handling.

Ask for Fully Descriptive Bulletin 6013.
Our Distributors and District Offices will welcome your inquiries.

THE CLARK CONTROLLER CO.

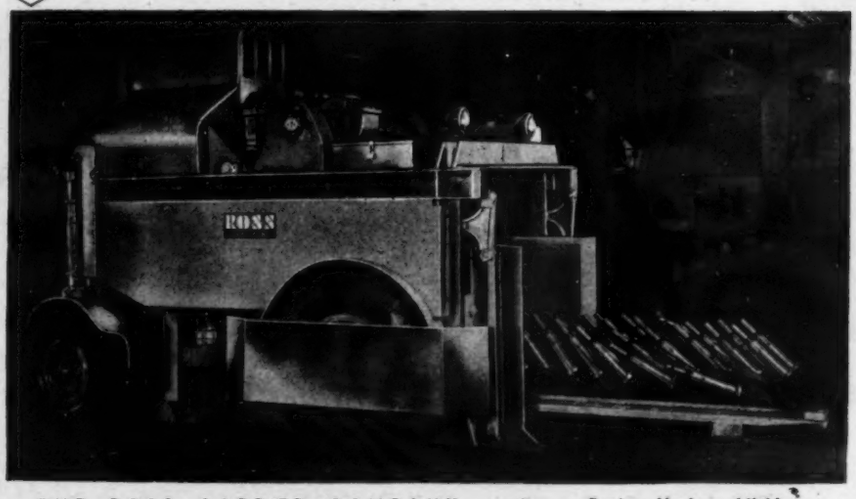
1146 EAST 152nd ST., CLEVELAND 10, OHIO • EVERYTHING UNDER CONTROL

ROSS SERIES 70 STRADDLE CARRIER

Operates Where No Other Carrier Can!

FASTER LOWER COST MATERIALS-HANDLING

Series 70 Straddle Carrier offers an economical solution to the ever-present problem of handling materials with maximum speed, at rock-bottom cost. Handles heavy, palletized loads with utmost efficiency over rough ground, through mud or snow. Maneuvers easily in crowded quarters . . . Get the details about how Ross Series 70 Straddle Carrier can reduce *your* materials-handling costs. Write today—ask for Bulletin FM-105.



THE ROSS CARRIER COMPANY • Benton Harbor, Michigan
Direct Factory Branches and Distributors Throughout The United States and Canada

ROSS
HEAVY DUTY MATERIALS-HANDLING EQUIPMENT

closed, and a stop prevents wires from twisting. Arm of lamp is adjustable in the base, which is made with same type of spring construction as socket. Swivelier Co., 30 Irving Place, New York 3.

Hand Tachometer

Development of portable hand tachometer without gears or gear shifts is announced. It is not a generator type. Head consists of a set of contacts operated by

rotating shaft. It has low driving torque, stability, and comes equipped with two disks allowing six feet-per-minute ranges, maker states. Metron Instrument Co., 432 Lincoln St., Denver 9.

Acid-Resistant Apron

Lightweight, acid-, alkali-, and oil-resistant apron, made from fabric coated on one side with a black vinyl resin, is announced. Edges are hemmed, and neck and waist

tape is in one piece, sewed into hem of the arm cut-out. Apron is suitable for use in canning and other industries. Two sizes are available—29x35 and 35x45 inches. The B. F. Goodrich Co., Akron, Ohio.

Machine Time Recorder

Instrument for recording machine running time has been developed for checking machine performance. Records the operating or "on" time of production machinery and other similar equipment. Chart record gives the total "on" time in hours, minutes, and seconds for a given period. "Off"

VOLU

In

FINISHING
THE NEW PRODUCTS

Mahon's 25 years' experience planning and building *completely mechanized finishing systems* is being utilized extensively by manufacturers who realize the importance of insuring a finer, faster job of finishing—with fewer men—at less cost.

If your production calls for changes to meet the difficult demands ahead, Mahon engineers will fully cooperate with you toward modernizing and economizing *your* finishing operations.

Address Inquiries to INDUSTRIAL EQUIPMENT DIVISION

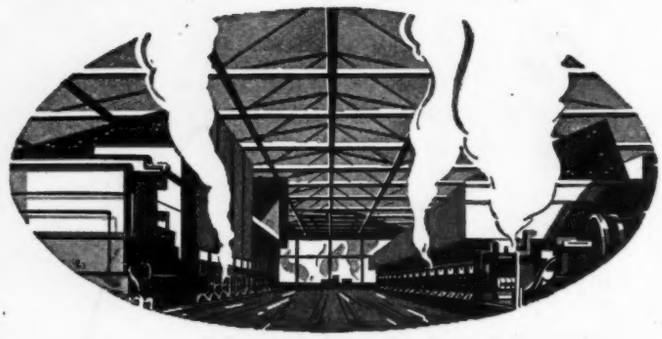
THE R. C. MAHON COMPANY

DETROIT 11 — CHICAGO 4

Designers and Manufacturers of Metal Cleaning Machines, Rust Proofing Machines, Hydro-Filter Spray Booths, Ovens of All Types, Filtered Air Supply Systems, Hydro-Foam Dust Collectors—and Many Other Units of Special Production Equipment—including Complete Finishing Systems.

YOU CAN PUT THIS ON PAPER

Wolmanized Lumber Lasts Longer*



Pulp mill structures, paper mills, and all wet process plants—built of ordinary lumber and materials—are inevitably subject to rapid deterioration. Roof planks and timbers, window frames and sash, floors and walls cannot withstand the steam and chemical-laden vapors . . . for long. Wolmanized Lumber, the wood impregnated with Wolman Salts* preservative, is highly resistant to this two-way attack. Wolmanized Lumber lasts *three to five* times longer!

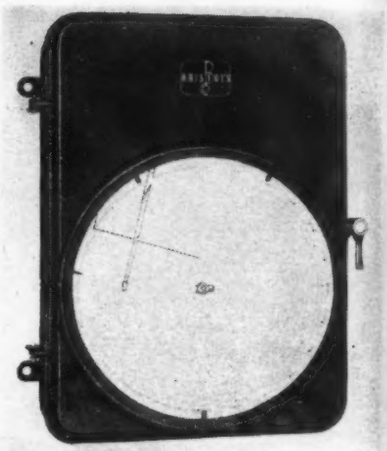
The advantages of building with wood

Building with wood means ease and speed of erection, light weight, resilience, high insulating value, paintability, low first cost and . . . when Wolmanized . . . long life.

*Registered trademarks

1676

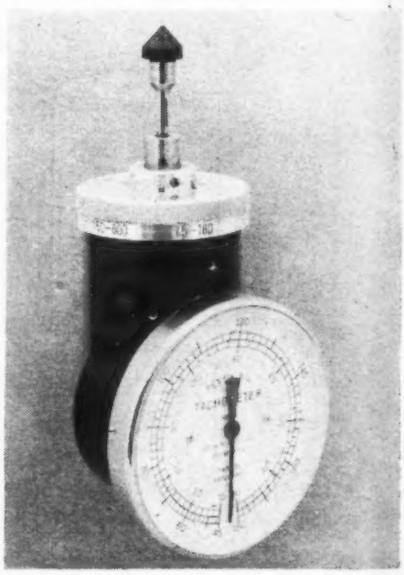
McCORMICK BUILDING, CHICAGO 4, ILLINOIS



periods are shown on chart as well as time at which they occur. Running-time readings are magnified so that total operating time of machine can be easily and accurately determined to within a few seconds. The Bristol Co., Waterbury 91, Conn.

Tachometer

Precision direct-indicating hand tachometer has two scales and five different ranges, 45-180 r.p.m., to 4500-18,000 r.p.m. Change of range is effected by rotation of knurled



barrel head. Instrument is supplied with carrying case and accessories, including a 6-in. circumference wheel for measuring surface speeds. James G. Biddle Co., 1211 Arch St., Philadelphia 7.

Portable Conveyor

One operator can set up portable conveyor system now available, maker states. Coming in open lengths of 60 or 100 inches, the sections can be folded like an accordion to 21 or 35 inches. Shorter section has four telescopic legs, and the longer has six, which permit movement of material by gravity. Rollers, in widths from 10 to 18 inches, are split in two. Material traveling down conveyor can take S turns without falling off. Each roller is designed to carry a load up to 80 pounds;

To New Product Development Engineers

GET THIS VALUABLE BOOK On Temperature Control

MAILED TO YOU WITHOUT OBLIGATION IMMEDIATELY

Before deciding on temperature regulating devices for your products, be sure to investigate Fenwal Thermoswitches They operate on an unusual principle, and offer many advantages not found in other types of switches. The Fenwal Engineering Data Book contains detailed drawings of construction of various models and typical installations.

- Compact construction permits installation in tight places.
- Make and break unaffected by external vibration.
- Readily adjustable for wide range of temperature control.
- Minutely accurate.
- Adaptable for all types of media.
- Inexpensive

• A 44-page treaties on Thermal Control including installation drawings, photographs, blueprints and descriptive suggestions for future planning with basic principles involved in temperature regulation and control . . . Just write for your *free* copy on your business letterhead.

"IF IT'S A FENWAL—IT'S THE BEST OF ALL"

THERMOSWITCHES

Fenwal, Inc.

FOR COMPLETE TEMPERATURE CONTROL

23 Pleasant Street, Ashland, Massachusetts

Dual Grip Assures Positive Electrical Contact
Tab Guides Lamp Insertion
Channel Guides for Inserting Lamp Pins
Sturdy Spring Assures Snap Action
Tapped Hole Simplifies Mounting
No Nut Required
Tapered Back Allows Space For End to End Mounting
Patented
Other Pats. Pend.
High Dielectric Strength

Lloyd

FLEX-LOC

Lamp Holder

FLEXIBLE—Automatic—self adjusting to variations in lengths of lamps and spacing dimensions in fixtures.

AUTOMATIC LOCK AND CONTACT is positive. Stands all shocks. Lamp cannot fall out.

INSERTING LAMP: Place lamp pins on both sides of lamp holder guiding tab. Push lamp up slightly and pins will slide into channels. As pins slide up to terminal holes, the holder is flexed outward, compressing the spring. As lamp pins enter holes, the holder snaps inward, with spring returning to normal.

TO REMOVE LAMP: Take hold of lamp with one hand. With other, press guiding tab of nearest lamp holder outward and the lamp will disengage itself.

LLOYD AUTOMATIC STARTER

IN THE NEW RED PLASTIC CAN

Stronger—Higher Dielectric Strength

When lamp becomes inefficient . . . flickers or blinks, Lloyd Automatic cuts off the current automatically . . . starts the new lamp when inserted, automatically.

Prevents overheating of ballast. Saves maintenance and power costs.

Listed and Approved by Underwriters' Laboratory Inc.

Certified by Electrical Testing Lab. Spec. 6.

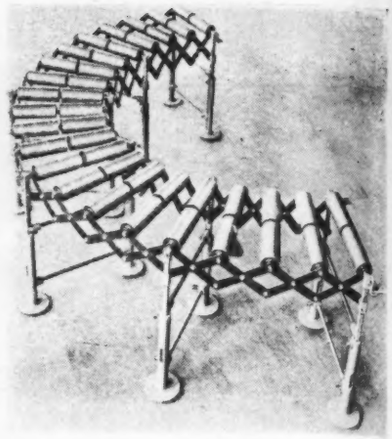
Pat. Nos. 2200443 2228210

LLOYD PRODUCTS CO.

LLOYD POLICY INSURES QUALITY

Providence 5, Rhode Island

Representatives — Branch Offices — Warehouse Stocks in 23 Leading Cities



the system therefore can be used for transporting semi-heavy material from one part of a plant to another without moving fixed features. Food Machinery Corp., Riverside, Calif.

Dust Collector

Belted motor-driven Air-Rester is used for collecting dust from grinding, buffing, and polishing machines. Designed for 25-cycle current, it also is available for 60 cycles. Model AR-14B has a ¾-hp. motor, 450-c.f.m. capacity and is 24x19x52 inches. The AR-24B has 1½-hp. motor with capacity of 1000 c.m.f., and dimen-

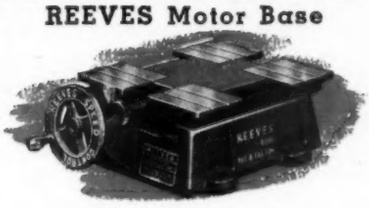
sions of 24x23x59 inches. Lower compartment contains suction fan with motor; dust collecting chamber is located on top of stand. Chamber is fitted with filtering pads for arresting dust and allowing the dust-free exhausted air to leave the stand at low velocity, without creating draft or air movement. The Standard Electrical Tool Co., 2492 River Road, Cincinnati.

Coolant Strainer

Industrial strainer known as the Strainco-Metex unit, is for use with turret lathes, screw machines, grinders, and other machine tools that employ a cutting oil or coolant flow. Prevents metal cuttings and chips from lodging in pump. Units are said to provide long-period capacity to hold dirt, chips, and grit; strainer refills can be installed, and old ones washed and re-used. Units can be supplied in various types, sizes, and capacities. Strainer Products Corp., 75-77 North Willow St., Montclair, N. J.

How to convert any standard constant speed motor to a Low Cost *Stepless Variable Speed Drive*

1 Mount Your Motor on This REEVES Motor Base

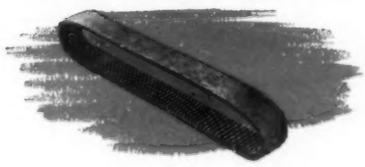


Base is built in wide range of sizes to fit any standard constant speed motor up to 15 h.p. Includes sliding platform and handwheel for moving motor forward or back.

2 Apply This Disc Assembly to Motor Shaft

Assembly consists of two facing cone-shaped discs, one stationary, the other sliding laterally, and compression spring for mounting on extension shaft of motor.

3 Connect to Driven Machine With This Special V-Belt



Place specially designed REEVES V-belt between discs and over pulley on power input shaft of the driven machine. Adjust belt to minimum center. Anchor motor base.

. . . and you have a

REEVES Vari-Speed Motor Pulley

available in sizes to 15 h.p. for stepless speed adjustability within 4:1 range.

HOW IT WORKS: The operation of a REEVES Motor Pulley is extremely simple—yet it follows the time-tested REEVES principle of a V-belt traveling between the adjustable driving diameters of cone-shaped discs. By turning handwheel, motor is moved forward or back on base, varying the driving diameters of the discs. As motor is moved toward driven machine, belt rides higher between discs, thus increasing the speed transmitted. Turning handwheel in opposite direction reverses the operation. Any speed within range is accurately maintained.

WHAT YOU CAN DO WITH IT: The REEVES Motor Pulley is the simplest dependable method of providing infinitely variable speed adjustability to a driven machine. With this low-cost, easy-to-install equipment you can transform a machine with fixed speeds into a far more versatile production unit—one that is instantly responsive to every changing condition and work schedule. Install REEVES Motor Pulleys on your machines in service, and when you buy a new machine, look for the familiar REEVES handwheel that signifies REEVES-equipped.

SEND FOR THIS CATALOG

New, 96-page book gives complete information on this and the two other basic REEVES Speed Control units—the Variable Speed Transmission and the Motodrive. Ask for Catalog F-450.

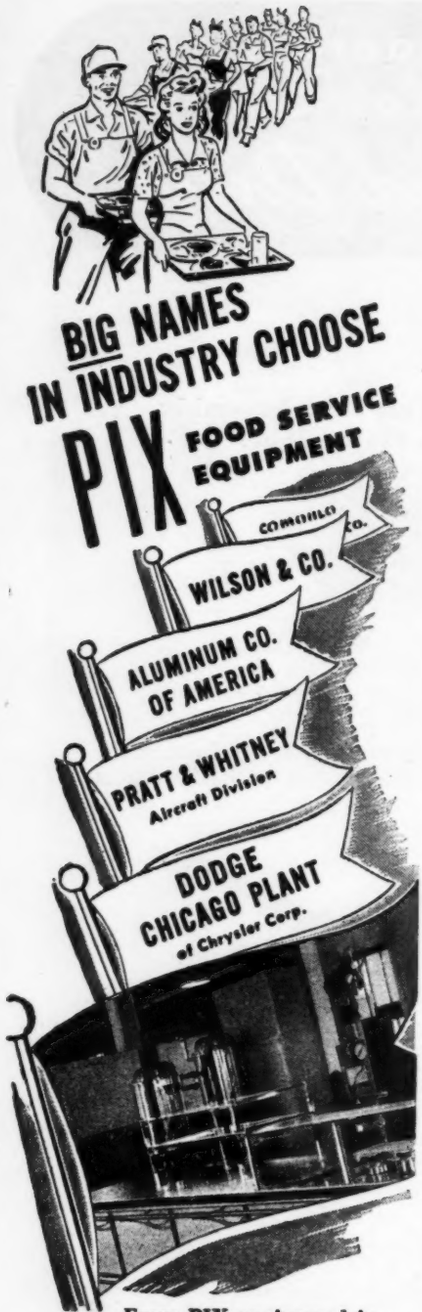
REEVES PULLEY COMPANY, COLUMBUS, INDIANA

Recognized Leader in the Specialized Field of Speed Control Engineering

Accurate Variable

REEVES Speed Control

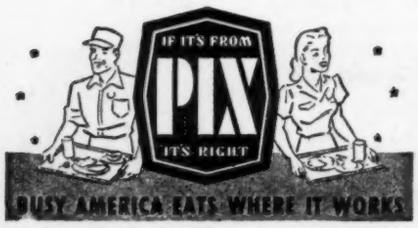
Gives the Right Speed for Every Job!



Every PIX engineered installation *inside* the plant speeds up food service to workers at the job . . . serves more people in the shortest possible time . . . provides better service in less space . . . all this because PIX engineers are thoroughly experienced through solving mass feeding problems in plants large and small all over the nation. Why not get the benefit of this wide experience right now!

Send for booklet PC8 on cafeterias, CW8 on PIX Portable food bars, or SB8 on PIX Rolling Snack Bars.

ALBERT PICK CO., INC.
2159 Pershing Road, Chicago 9



YOU WANT TO KNOW

more about the items mentioned on this page

Letters to the addresses given will bring information

• VOCATIONAL RESEARCH showing new procedures for developing job standards and for placing personnel. Complete kits including job qualification inventory forms and 370-page Job Placement Reference available. Also samples. National Institute of Vocational Research, Inc., 215 West 5th St., Dept. C, Los Angeles 13.

• REPORT ON STANDARDIZATION proposals for raw materials, products, and safety, by Policy Committee of industrial representatives appointed by Department of Commerce. Recommends scope of American Standards Association should be broadened to handle all major details of any standardization project deserving national recognition. Full report appears in current issue of *Industrial Standardization* published by American Standards Association, 70 East 45th St., New York 17.

• CLASSIFICATION OF PLASTICS as used for molding, presented in chart form as an authentic guide to various properties established by material makers and molders. Copies on request. Society of the Plastics Industry, Inc., 295 Madison Ave., New York 17.

• ACID RESISTANCE for wood within broad limits achieved by plastic impregnation. Technical Department, Wood Preserving Division, Koppers Co., Inc., Orrville, Ohio.

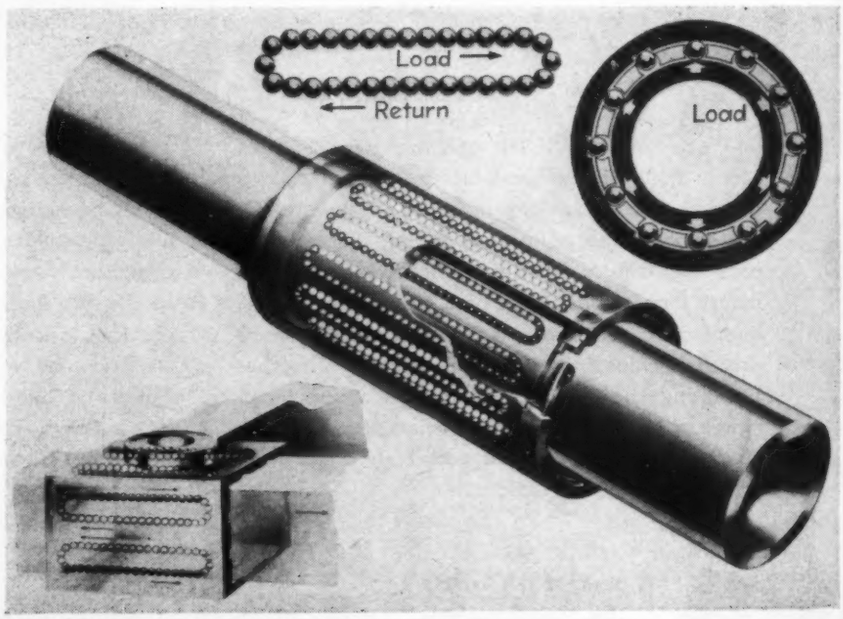
• RUBBER PRODUCTS' relation to winning of the war told in pictorial booklet, *We Had to Have Rubber*. Rubber Manufacturers Association, 444 Madison Ave., New York.

• POST-WAR LABOR POLICY, a survey of opinions of 600 persons representing management, labor, and professions. Shows 59 percent approval for work of War Labor Board, and other conclusions. Published by Bureau of National Affairs, Inc., 24th and N Streets, Washington, D. C.

• ALUMINUM PROTECTION from corrosive atmosphere such as salt spray provided by Alumox process of chemical treatment, applied by dipping in a solution at 210 degrees from 2 to 15 minutes. Booklet available. The Enthone Co., 442 Elm St., New Haven, Conn.

• CORROSION PROTECTION for cadmium and zinc accomplished by dipping in Unichrome at room temperature. Folder available. United Chromium, Inc., 51 East 42nd St., New York 17.

• METAL VENEERS in which thin sheet of special type is bonded to any of a variety of other types, in varying



BALL BUSHING permits unlimited travel of reciprocating mechanical members with varied shapes. Called a revolutionary principle, the ball bushing contains a series of circuits through which large numbers of ball bearings move. Supplementary illustrations show typical path of motion. The Kotula Company, 400 Madison Ave., New York 17

CHATTER...CHATTER...CHATTER...
WAS RUINING FINISH

SUN TABLEWAY LUBRICANT...

Ended Chatter, Produced Smoother Operation, Cut Down Rejects

A midwestern manufacturer was unable to obtain a satisfactory finish in grinding hardened parts, because of excessive chatter in the grinding machines. When he used a heavy oil, the machines were sluggish. When he used a thin oil, the tableways chattered and affected the finish of the work.

After changing to Sun Tableway Lubricant, it was possible to maintain smoother operation, and to eliminate chattering.

Fewer rejects were encountered, and the management standardized on this Tableway Lubricant throughout the plant.

Sun Tableway Lubricant, with its extreme pressure characteristics and non-gumming qualities, is an outstanding example of Sun's industrial lubricants.

For every type, make, and size of industrial machine, for prime movers, conveyors, pumps, compressors, electrical equipment, etc., there is a specially prepared Sun oil or grease. Call in the Sun Engineer in your area and find out about the savings possible with the right lubricant in the right place.

SUN OIL COMPANY • ***Philadelphia 3, Pa.***

Sponsors of the Sunoco News Voice of the Air — Lowell Thomas

SUNOCO **SUN INDUSTRIAL PRODUCTS**

OILS FOR AMERICAN INDUSTRY

This story will interest you!

A 93-foot open tank of crude oil was deliberately fired. The question to be answered was: Could Fire-Fog control and prevent the spread of fire over such a large area and still keep the tank from being destroyed?

It could and it did! By almost instant control of the burning area Fire-Fog did such an amazing job that the paint on the tank wasn't even blistered! *Fire-Fog's mist-fine water spray kept the temperatures inside the tank down to a maximum of 40 degrees in the center and 110 degrees around the outside.*

Then a second test was made—and a third—still no damage to the tank. Positive proof that Fire-Fog does protect vulnerable fire areas—definite support to the soundness of the principle of fire protection by controlled burning of flammable liquids.

Automatic in operation and supersensitive to quick heat rises, Fire-Fog is ideal for quenching fires of flammable liquid origin. Positive protection for such areas as loading racks, process buildings and areas, flammable liquid pump houses, valve pits and the like.

"Automatic" Sprinkler

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA

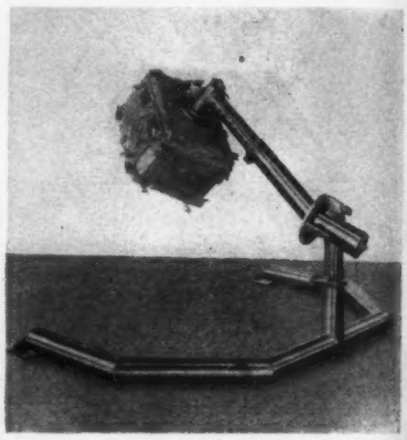
YOUNGSTOWN, OHIO . . . . . OFFICES IN 36 CITIES

"Automatic" Sprinkler manufactures and installs a complete line of fire protection devices and systems for all types of fire hazards. Listed by Underwriters' Laboratories, Inc., and approved by Factory Mutual Laboratories.

thickness. Used principally with steels but also effective with copper, silver, gold, and platinum. Ampco Metal, Inc., 1745 South 38th St., Milwaukee 4.

• HOW THE AUTOMOTIVE COUNCIL helped to expedite war production and to pave the way for automotive reconversion, shown in text and photographs in a 16-page booklet. Obtainable without charge from Automotive Council for War Production, New Center Bldg., Detroit 2.

• STAMPING INK for sticking to slick plastic surfaces, metal, and glass. Product named Slink is also suitable for cellophane and waxed paper. Available in six colors. Louis Melind Co., 362 West Chicago Ave., Chicago 10.

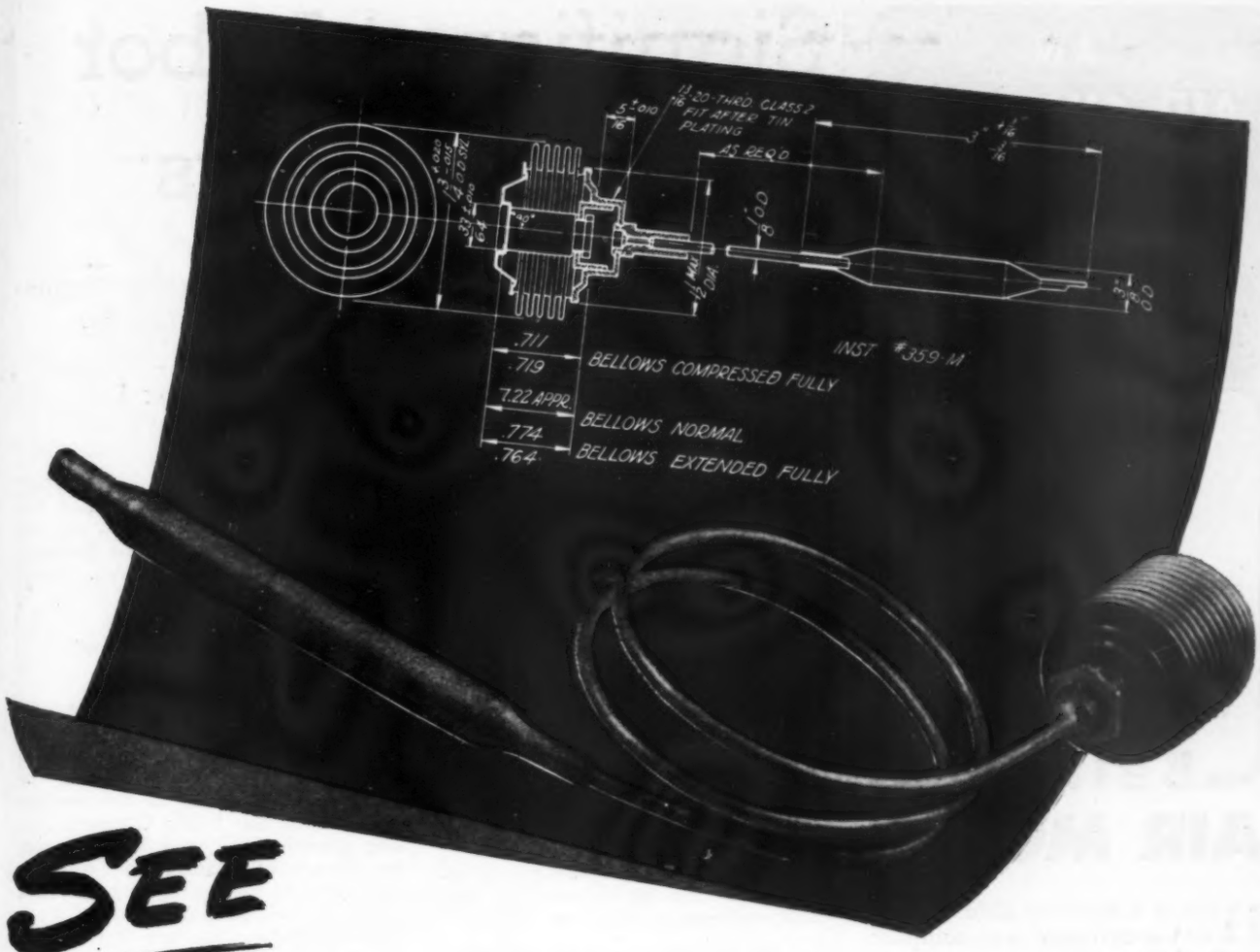


WORK POSITIONER to aid assembly operations is manually controlled through 360 degrees of rotation and 135 degrees of tilt. Center of gravity remains in one position. Bentley Weldery, Inc., Dept. N, Box 1038, Syracuse, N. Y.

• BOX STRAPPING of flexible steel, sheathed in waterproof paper. Provides safeguards against cutting sides of corrugated boxes, and can be applied to enameled or painted surfaces without marring. Also reduces danger of cut fingers. Paper surface may be printed. A. J. Gerrard & Co., 221 North LaSalle St., Chicago 1.

• NEW FILMS: *Peace Comes to America*, 16-mm 10-min. feature produced by War Finance Division, U. S. Treasury, Also, *Diary of a Sergeant*, 22 minutes; *Stillwell Road*, 50 minutes; *It's Your America*, 35 minutes; *Target Invisible*, 15 minutes; *Army Air Forces —Pacific*, 18 minutes; *Voyage to Recovery*, 10 minutes. All related to Victory Loan drive. Motion Pictures and Special Events Section, War Finance Division, U. S. Treasury Department, Washington.

"Movies Go to Work," a booklet giving industry reasons for adopting motion pictures as a management tool and telling what steps to take to get going and keep going. Copies available from Bell & Howell Co., 7100 McCormick Road, Chicago 45.



SEE

YOUR PLANS COME TO LIFE . . . EXACT . . . ON TIME!

TODAY . . . manufacturer after manufacturer is turning to Bridgeport Thermostat . . . not only for bellows and bellows assemblies . . . but for the complete solution to all bellows application problems.

In the first place . . . Bridgeport maintains an extensive engineering organization to give prospective customers and customers a complete service in designing, experimentation, production, testing, etc.

Complete assemblies . . . Bridgeport's plant is equipped with precision machines manned by highly trained mechanics to turn out assemblies at low cost and in any quantity.

Many manufacturers, therefore, find it more economical to purchase complete assemblies rather than buy the individual bellows and then produce the assemblies themselves; especially since the training of personnel and the installation of equipment is often quite an expense item. This is doubly true if the assembly is to serve as a thermostat . . . here the filling, sealing and calibration must be executed with infinite pains to produce a precision instrument for continued satisfactory performance.

Any inquiry will receive prompt, careful consideration. In the meantime write for catalog TF-100

Bellows Assemblies . . . Bellows . . . Bellows Devices

BRIDGEPORT THERMOSTAT COMPANY INCORPORATED BRIDGEPORT, CONN.

AN
AIR CYLINDER
so different
so flexible
so complete

we call it the
Bellows
AIR MOTOR

HERE is a radically different type of air cylinder — so compact, so flexible, so simple to use, you'll think of a hundred places where it can improve production processes — save time, money and physical effort.

NO SEPARATE VALVES OR CONTROLS TO BUY

Bellows Air Motors are complete power units in themselves, with built-in valve, valve operating lever and stroke speed controls.

NO CUMBERSOME PIPING TO INSTALL

Bellows Air Motors require only *one* air connection which can be made easily and quickly by flexible hose.

INEXPENSIVE TO BUY — ECONOMICAL TO OPERATE

Bellows Air Motors operate on any air pressure up to 175 psi. Model BM5 delivers a power force 5 times air line pressure, Model BM10, a force 10 times air line pressure. Stroke lengths available 1" to 48".

Write for Bulletin BM645

The Bellows Co.
SENACON DIVISION
861 East Tallmadge Ave. Akron, Ohio

Significant Labor Developments

BENJAMIN WERNE, Lecturer in Government Regulations, New York University, Member of the New York Bar

Period Surveyed: August 1 to September 1

TREND INDICATORS

Manpower Controls Terminated

CESSATION OF HOSTILITIES has put an end to compulsory manpower controls, including the minimum wartime work week, employment ceilings, and requirement for certificates of availability. Voluntary methods are now to be used for the channeling of labor. For the remainder of its duration, the WMC will devote itself to counseling and assisting employers, workers, and especially veterans, in making job adjustments.

Avoiding Anti-Discrimination Violations

To enable employers to avoid possible pitfalls under the anti-discrimination laws, additional warnings have been issued:

1. Be wary of inquiring into the citizenship status of the applicant's parents.

2. Avoid asking an applicant's citizenship status unless foreign service is involved.

3. Do not inquire as to the name of the primary school attended by the applicant, because it may reveal the individual's religion.

4. In character investigations, avoid specifications as to race, color, creed, or national origin.

5. In inquiring into social affiliations, exclude lodges and church societies.

Employer Ordered to Compute Pay

A company was ordered by the WLB to discontinue the practice of having its employees compute their own pay checks although done on company time. Such practices resulted in confusion because the computations, involving incentive earnings, were complicated and could not be completed in the time allotted by the company for this purpose. The board directed the company to turn this job over to its payroll department. (Firestone Rubber & Metals Products Company, RWLB-XI)

Waiver of Overtime Pay Disallowed

The Circuit Court of Appeals held that irrespective of the existence of a *bona fide* dispute between the employer and employees as to coverage, the employees' releases of claims to liquidated damages will not prevent a subsequent suit for their recovery. Disagreement as to the legal interpretation of the law turning upon the nature of the employer's business may not be used as a basis for reducing payments below those required by the Act. (Gangi vs. D. A. Schulte, Inc., CCA-2)

Alleged "Constant Wage Plan" Invalid

Despite the employer's contention that his employees were receiving time and one-half for hours worked in excess of 40 a week under a "constant wage plan," he was found in violation of the overtime provisions of the Public Contracts Act. The administrator found that the plan was not put into practice but rather that the employees were being paid piecework rates regardless of the number of hours worked. Moreover, the fact that the employer was being prosecuted under the Public Contracts Act did not immunize him from proceedings under the Wage-Hour Law, should violation of the latter be similarly found. (United Distillers Products Corporation)

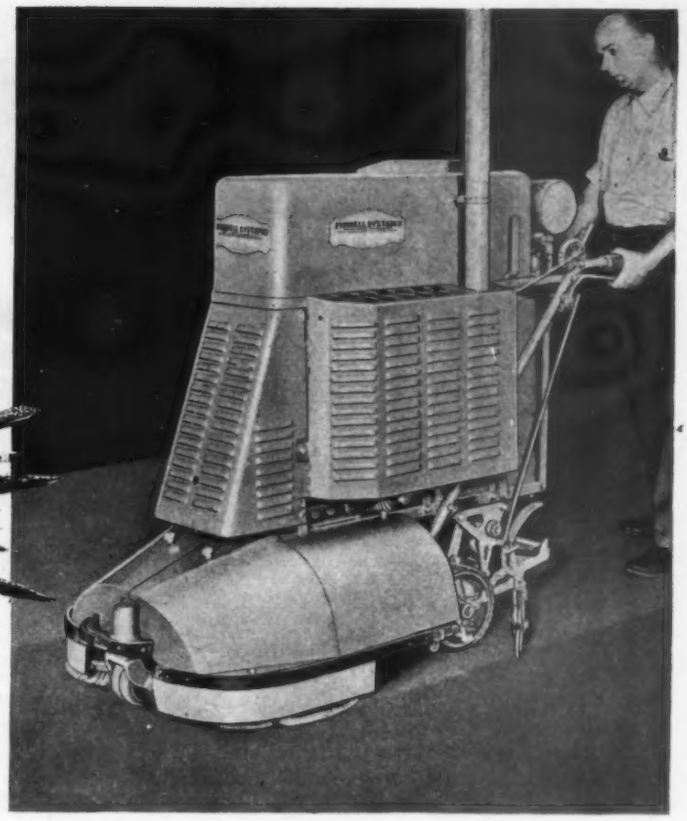
Held Time Worked

Reporting and travel time of employees in a shipyard. The court held that for the purposes of the Wage-Hour Law compensable time begins when the employees check in at the employer's premises ready for work. In the case involved, the employees reported to work before the actual change of shifts so that they could answer the roll call and be instructed as to the day's work. The court pointed out that the employees were there for the company's benefit and were subject to its control; therefore they should be paid. (Ballard vs. Consolidated Steel Corporation, Ltd., USDC S. Calif.)

Burden of Increased Costs on Contractor

The Board of Contract Appeals, in refusing to make any adjustment for a substantial wage increase effected by a lump sum contractor pursuant to a WLB agency order, shifts the costs of the increases to the contractor. The board explained that reimbursement would be possible only if the additional expenses to the company were a result of changes in the specifications of the contract made by the govern-

SETOL IN YOUR SCRUBBER . . .



Gives You *Cleaning Action* WITH EVERY TURN OF THE BRUSHES!

Machine-scrubbing calls for *cleansers of action!*—especially if you want to keep down the operating time of your machine and save on labor. *Setol,* the mineral oil solvent expressly designed to work in scrubbing machines used on mill and factory floors, acts *instantaneously* in emulsifying grimy oil and grease, enabling your machine to remove the accumulation in minimum operating time. And *Setol* is otherwise an economy—requires but one pound in ten gallons of water.

There are *six* cleaning compounds in the *Finnell* line, each specially compounded for machine-scrubbing. In addition to *Setol,* there's *Finola Scouring Powder,* for heavy duty scrubbing of hard surface floors and some wood floors . . . *Solar Soap Powder,* for use wherever a good *soap* powder is required . . . *Finnell Rubber Cleaner* . . . *Century Scouring Powder,* a mild abrasive cleanser . . . *Asesco Solvent Cleanser* and Water Softener. All are compounded in *Finnell's own powder mill.* Containers range from 5-lb. bags to 300-lb. barrels.

For literature or consultation, phone or write nearest *Finnell* branch or Finnell System, Inc., 2510 East Street, Elkhart, Indiana. Canadian Office: Ottawa, Ontario.

IF YOU NEED NEW SCRUBBING EQUIPMENT . . . investigate the advantages of a Job-Fitted Finnell.

Buy and Hold Victory Bonds

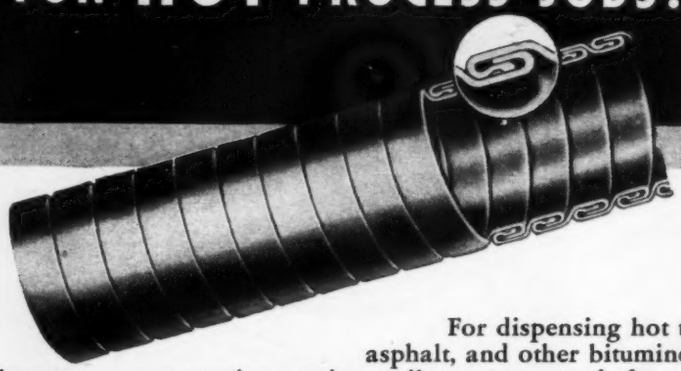
FINNELL SYSTEM, INC.

Pioneers and Specialists in

FLOOR-MAINTENANCE EQUIPMENT AND SUPPLIES

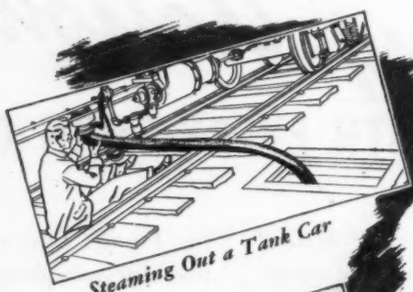
BRANCHES IN ALL PRINCIPAL CITIES

Specify REX-TUBE FOR HOT PROCESS JOBS!

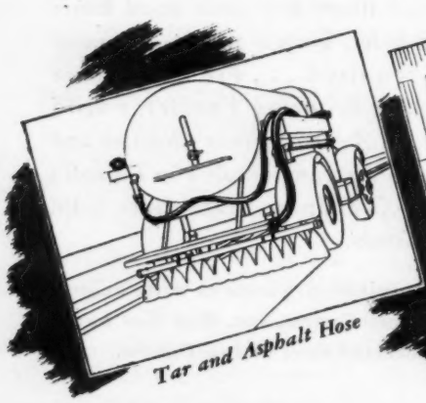


For dispensing hot tar, asphalt, and other bituminous substances . . . conveying various oils, greases and fats . . . handling steam at low and moderate pressures . . . in fact, for virtually all "hot" process jobs . . . use *REX-TUBE*, Type RT-15.

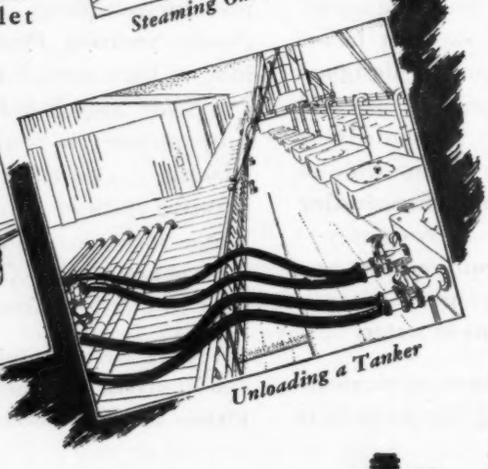
This fully interlocked flexible metal hose . . . made from heavy strip steel or bronze . . . has the strength and ruggedness to withstand rough handling. In addition, its inner packing of high-grade asbestos guards against leakage. Sizes range from 1″ to 12″ I.D. When you need flexible metal hose for heavy duty and general utility service, be sure to specify REX-TUBE. Write today for Booklet E-144.



Steaming Out a Tank Car



Tar and Asphalt Hose



Unloading a Tanker

Flexible Metal Hose for Every Industrial Use

ARMY E NAVY

CHICAGO METAL HOSE CORPORATION

MAYWOOD, ILLINOIS

Plants: Maywood and Elgin, Ill.

ment in its contractual capacity. (H. E. Millis Contracting Corporation)

Held Exempt From Wage-Hour Law

Employees engaged by an interstate motor carrier as stackers to load freight into trucks and trailers and checkers to obtain bills and manifests on out-going freight, inspect and check freight, supervise loading operations, and inspect loaded trucks and seal them for shipment, since both are engaged in operations which affect the safety of operation of the motor vehicles. (Walling vs. Gordon's Transports, Inc., USDC W. Tenn.)

Held Under the Act

Janitors employed in a terminal of an interstate bus company, since the operation of the terminal was found to be a necessary and integral part of the company's interstate business. (Walling vs. Atlantic Greyhound Corporation, USDC E. S. C.)

WAR LABOR BOARD

* *Guaranteed Wage Plans*

The annual wage agreement recently negotiated by the steel industry contains features which should be carefully studied by all companies potentially affected by the question of guaranteed wages. The company guarantees to every employee who has completed five years' continuous service in the employ of the company at the time of the execution of the agreement, a minimum of 1200 hours for the year covered by the agreement. All hours worked by the employee, both straight time and overtime, are to be credited against the 1200 hours. If the company does not provide work for any part of the 1200 hours, the employee is to be paid for the unworked hours at his straight-time hourly rate. An employee who voluntarily leaves the employ of the company, or who is discharged for cause, is not to be entitled to the guarantee. In the event of an employee's failure to take advantage of available work hours, such hours shall be deducted from the guaranteed 1200 hours.* In the event of a strike the company is to be relieved of its guarantee as to the employees striking.

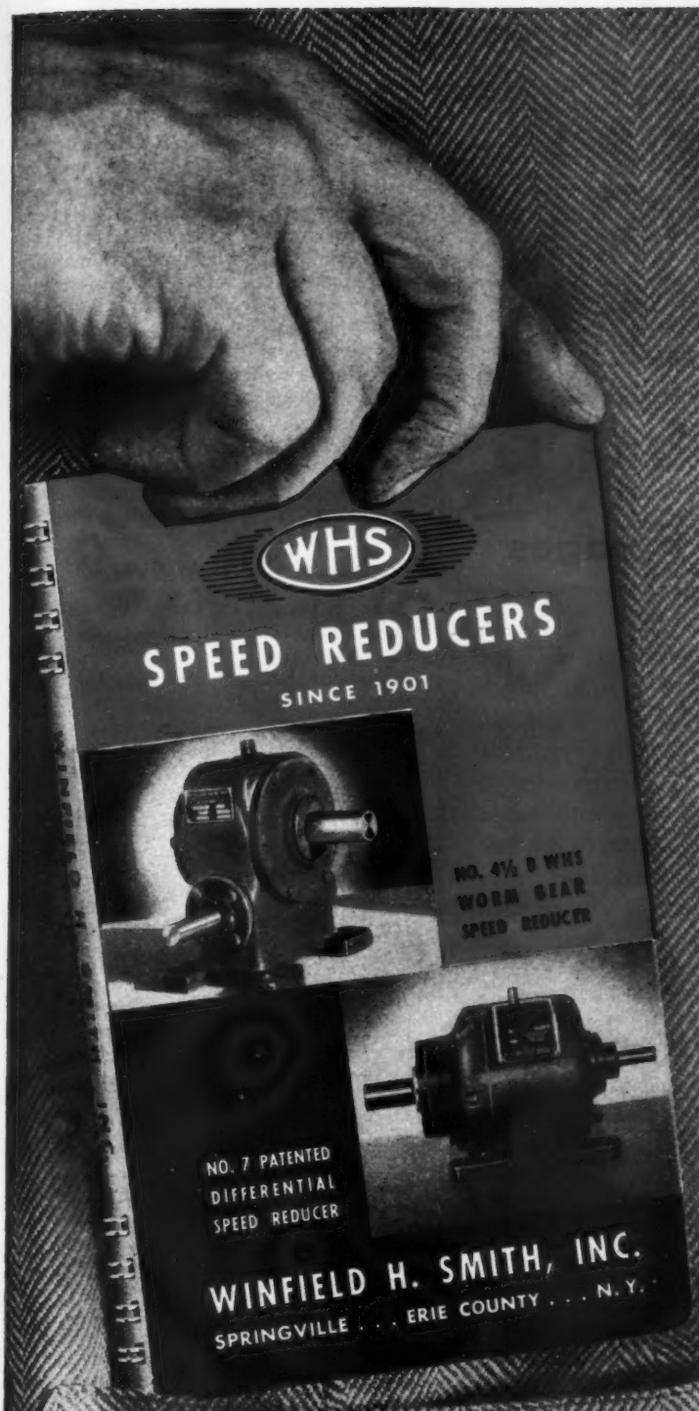
* *Guaranteed Wage Ordered*

The national board denied a review of a regional board's grant of a guaranteed wage plan as follows: Regular full time employees are to be guaranteed 44 hours of work per week for 52 consecutive weeks per year. Regular part-time employees are to be guaranteed employment for five nights and a Saturday weekly for 52 consecutive weeks per year. (Melville Shoe Corporation, WLB)

Premium Pay Order Revoked

General Order No. 9240, regulating the payment of premium rates which might be

* In this and the following classification items marked with an asterisk also are considered to be trend indicators.


WHS
SPEED REDUCERS
SINCE 1901
NO. 4½ B WHS WORM GEAR SPEED REDUCER
NO. 7 PATENTED DIFFERENTIAL SPEED REDUCER
WINFIELD H. SMITH, INC.
SPRINGVILLE . . . ERIE COUNTY . . . N. Y.

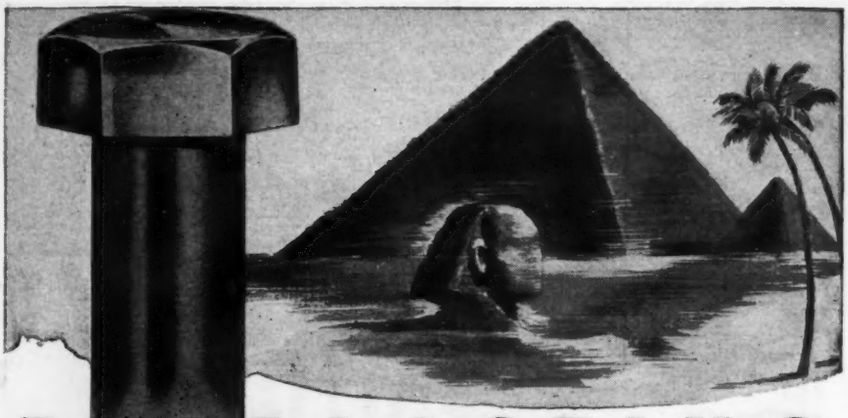
Your
POCKET-SIZE EDITION
of the
WHS
SPEED REDUCER CATALOG
is ready!

Everything contained in our recently published file-size Catalog No. 144 is condensed into very readable, practical form in this new Junior Catalog No. 145. Includes a comprehensive Engineering Section as well as valuable data on overhung loads, lubrication, torque vs. horsepower, selecting your Speed Reducers, etc.

To secure your copy of Catalog No. 145 please address us on your business letterhead, stating position held. WHS Speed Reducers are manufactured by the "Makers of the First Speed Reducers in America to be Shipped from Stock".

WINFIELD H. SMITH, Inc.

222 FREY AVENUE ...SPRINGVILLE... ERIE COUNTY ...NEW YORK



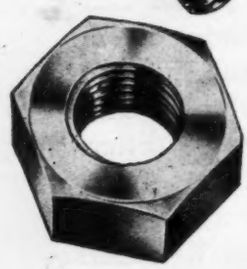
EVERLASTING

against the ravages of time

For countless ages, the Pyramids of Egypt have withstood the disintegrating forces of time and the elements. In comparison with the span of human life, the Pyramids are everlasting. In applications without number, Harper bolts, nuts and other fastenings resist rust, corrosion and other destructive conditions. Compared with assemblies they hold together . . . or with common steel bolts . . . Harper Fastenings are everlasting.

everlasting fastenings

Every Harper fastening is made of brass, bronze, copper, Monel metal, or stainless steel (none of common steel). Harper stocks include over 4360 items of bolts, nuts, screws, washers, rivets, nails, and special fastenings. New stock items are being continually added. Special fastenings made to order quickly from large stocks of metal in bars, rod, wire, sheet and other basic forms. Write for 104 page, 4 color catalog.



THE H. M. HARPER COMPANY

2651 Fletcher Street • Chicago 18, Illinois

BRANCH OFFICES: New York City • Philadelphia • Los Angeles
Milwaukee • Cincinnati • Houston

Representatives in Principal Cities

BRASS . BRONZE
COPPER . MONEL
STAINLESS

HARPER
Chicago

LABOR DEVELOPMENTS (continued)

paid for weekend and holiday work by employers engaged in war work, has been revoked by the President. Obligations incurred before August 21 (the effective date of the suspension), however, must be respected. For those war workers who performed work for prime contractors and subcontractors in government war contracts, and those who produced materials and supplies necessary to the performance of these contracts on August 15 and 16, the President has ordered that they be compensated at time and one-half for such work, that these two days be counted as days of work in computing the seventh work day whether or not work was performed, and that they be counted in computing the sixth work day where premium pay is required by existing contractual arrangements in a particular plant.

Presidential Order No. 9599

The new Presidential Order No. 9599 not only exempts wage adjustments not affecting price ceiling from wage stabilization regulations, but also authorizes the WLB to make adjustments necessary "to correct maladjustments or inequities which would interfere with the effective transition to a peacetime economy" without regard to the limitations of the Little Steel formula or other stabilization limits. Order 9599 marks the end of the "Hold-the-Line" Order.

Revocation of WLB's General Orders

Recently repealed by the WLB were General Order No. 31, prescribing strict rules relating to individual wage or salary adjustments for promotions, merit, length-of-service, and advancement under trainee or apprentice systems, limitations on total amount of adjustments to the 5- and 10-cent rule, and limits on hiring of new employees at rates above the range minimum; General Order Nos. 1, 1A, and 3, relating to wage and salary increases which were ordered or put into effect before October 3, 1942; General Order No. 2, relating to procedure for the adjustment of labor disputes affecting wages; General Order No. 11, relating to increases given before November 7, 1942; and General Order No. 26, relating to salary adjustments of employees of non-profit organizations.

Increases Permitted

Employers may now effect voluntary increases without prior WLB approval, provided these wage increases do not serve as a basis for increasing price ceilings. In the case of retroactive increases, however, it is prudent to obtain board approval, since the policy in this respect is not yet clearly defined. Moreover, the WLB has been empowered to exceed the Little Steel formula limitation in making adjustments to correct gross inequities or to effectuate the transition to a peace economy. Similarly, bracket rates may be disregarded by the board in making adjustments in individual cases.

Employers may now make increases to employees subject to Salary Stabilization

Whether it's water cooling for a steel mill or refrigeration for a cafeteria

Specify the favorite
Specify Frigidaire

CARNEGIE-ILLINOIS STEEL CORPORATION, Pittsburgh, Pa., nineteen years ago made its first installation of Frigidaire water coolers in the open-hearth section of its Homestead, Pa. plant. Since then, hundreds of Frigidaire water coolers have been installed in Carnegie-Illinois Steel plants in various parts of the country to provide steel workers with drinking water cooled to just the right degree. Carnegie-Illinois Steel's investment in Frigidaire water coolers has enabled them to effect savings of thousands of dollars annually over old-fashioned methods.

FRIGIDAIRE REFRIGERATION and Air Conditioning equipment serves in many ways. Here are a few of its almost unlimited applications:

Water Cooling for factory and general office workers, private offices, cafeterias, dining rooms and a wide range of industrial processing applications.

Refrigeration for preserving meats, vegetables, fruits, baked goods, ice cream and other dairy products and for cooling bottled beverages in factory cafeterias, dining rooms and lunch counters. Also for providing low temperatures for many types of processing applications.

Air Conditioning for rest rooms, cafeterias, medical centers, private and general offices, conference rooms, laboratories and testing rooms and in manufacturing and assembly areas where control of temperatures and humidity contributes to improved quality of the product and greater employee well-being and efficiency.

Whatever you may need— cooling, refrigeration or air conditioning—consult your Frigidaire Commercial Dealer. He will be able to tell you about the kind of equipment that will meet your needs most effectively . . . give you the latest information on when this equipment may be available. Find his name in classified section of 'phone book. Look under "Refrigeration Equipment". Or write Frigidaire, 618 Amelia St., Dayton 1, Ohio. In Canada, 395 Commercial Rd., Leaside, 12, Ontario.

For Excellence in War Production

FRIGIDAIRE

Made only by

GENERAL MOTORS

Peacetime Products

COMMERCIAL REFRIGERATION • AIR CONDITIONERS
BEVERAGE, MILK, AND WATER COOLERS
REFRIGERATORS • RANGES • WATER HEATERS
HOME FREEZERS • ICE CREAM CABINETS

FOR 101 METAL CUTTING JOBS . . .

WELLS NO. 8

Handy as a

WITH A WELLS No. 8 you can efficiently cut any size, shape or type metal you can fit into the saw. The work is simply clamped into the quick-acting vise and cutting begins. No more attention is required, for the gravity-feed and the automatic shut-off do the rest. Use your Wells for all types of cut-off work —in stores, tool rooms, maintenance. Move your portable Wells to the work and save time and labor. A simple wet cutting system is available for all Wells No. 8 models to allow coolant use on tough cutting jobs. It's a handy tool . . . this low-cost, versatile Wells No. 8. Write for details.

Specifications

CAPACITY: Rectangular 8" x 16" (Special Guides) . . 5" x 24"
ROUNDS: . . . 8" Diameter
MOTOR: . . . ½ H. P., A. C. or D. C.
SPEEDS: Selective 60, 90, 130 ft. per min.
WEIGHT: . Approximately 750 pounds

Wells SAWS

Wells

Products by Wells are Practical

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION
1414 TAYLOR ST., THREE RIVERS, MICHIGAN

LABOR DEVELOPMENTS (*continued*)

Unit regulations without Treasury approval provided such increases are not used as a basis for seeking price ceiling adjustments or result in increases in cost of goods to the government. If the employer has an application pending before the Salary Stabilization Unit, he need not wait for a formal reply, but may make the adjustments any time he wishes. In the case of decreases, however, approval must be obtained unless the decrease is matched by a substantial reduction in the employee's duties and responsibilities, or it does not fall below the highest salary level rate for the particular job between January 1 and September 15, 1942.

Under recently amended orders, an employer may pay, without WLB approval, merit, length-of-service, reclassification increases, and the like, provided they are made under the terms of a wage agreement or incident to an established wage rate schedule; bonuses of every type and description, including military severance bonuses; increases made pursuant to an escalator clause to compensate employees for increases in the cost of living; increases to equalize men's and women's rates for the same quantity and quality of work; and increases made pursuant to requirements of a state minimum wage law.

Approval Required

Wage adjustments in the building and construction industry are still subject to WLB approval before they can be put into effect. The probability of having these adjustments approved, however, is greater than in wartime, since the board has been empowered to approve increases necessary to correct maladjustments or inequities which would interfere with the transitional period. This regulation (General Order No. 41) will remain in effect for 90 days or until further notice.

Reconversion Policy Over Disputes

Labor-management disputes will still be referred to the WLB for settlement where they would interrupt work contributing to the production of military supplies or would interfere with the effective transition to a peace economy.

The board has been empowered to make adjustments in correcting inequities and inequalities, maladjustments, and substandards of living; even to the extent of exceeding the Little Steel formula and sound and tested going rates, where necessary.

Employers are urged to renew collective bargaining or refer to arbitration all dispute cases pending before the board. If an agreement cannot be reached by further bargaining, the employer may (1) submit the dispute to voluntary arbitration; (2) accept the decision of the board or board agency as final, voluntarily waiving his right to appeal to the national board; or (3) agree to withdraw certain issues from the case, leaving only the really important issues for the board to settle.

* *Reduction in Work Week Permitted*

Employers may reduce the regular work week without a proportionate reduction in

The CONE AUTOMATIC MACHINE COMPANY

sees many

GOOD THINGS AHEAD

It is reported that . . . . . .

The National Research Council is compiling a directory of industrial research laboratories of which there were 2,264 in 1940 when the last listing was made.

get ready with CONE for tomorrow

Said to be the largest government-owned plant yet leased for civilian use, a 21 million dollar factory is being converted for the making of streamlined trains. *Edward G. Budd, Philadelphia.*

get ready with CONE for tomorrow

Experimental track-type tractors are using rubber tracks quite similar to those used on children's toys. *B. F. Goodrich.*

get ready with CONE for tomorrow

A new technique, using an electric arc, makes it possible to cut industrial diamonds four times faster than the conventional method. *National Bureau of Standards.*

get ready with CONE for tomorrow

An aviation magazine estimates that American domestic and international air carriers will put almost $750,000,000 in equipment in the next five years. *Aviation News.*

get ready with CONE for tomorrow

A unique type of power transmission, which is positive and yet prevents gear breakage in case of jamming, uses metal gears meshed with gears of an elastic vinyl resin. *Resistoflex Corp.*

get ready with CONE for tomorrow

Tooling has begun for the production of a calculating machine that automatically figures dividends, hourly pay rolls, writes checks and keeps records at 4,000 per hour speed. *Addresso-Multigraph Corp.*

get ready with CONE for tomorrow

A dry cell developed for the Army is reported to have 5 times the shelf life of ordinary batteries. A 93.6 volt radio battery of 72 cells weighs only 2 pounds. *Engineering & Mining Journal.*

An oxy-acetylene cutting unit developed by the Navy can be carried on the operator's back and used without setting it down.

get ready with CONE for tomorrow

One of our admirals reports that welded ships have proved to be stronger than riveted ones during the war. *Admiral Emory S. Land.*

get ready with CONE for tomorrow

The American optical industry is now producing, by automatic, mass production methods, lenses superior to those formerly made by hand in Germany.

get ready with CONE for tomorrow

The Army has been using a very compact radio communication system that can carry facsimile pictures, telephone conversation and teletype messages all at once.

A new pocket-size instrument reports power output and efficiency to the pilot of a plane by measuring constantly the deflection of the engine under the force of explosions. *Consolidated-Vultee.*

get ready with CONE for tomorrow

Claims for a new rubber cement include adhesion to metals, plastics and ceramics; shear strength of 3,250 pounds per square inch and tension strength of two tons. *B. F. Goodrich, "Plastilock"*

get ready with CONE for tomorrow

The first section of the Society of Automotive Engineers to be established outside continental United States has been organized in the Hawaiian Islands.

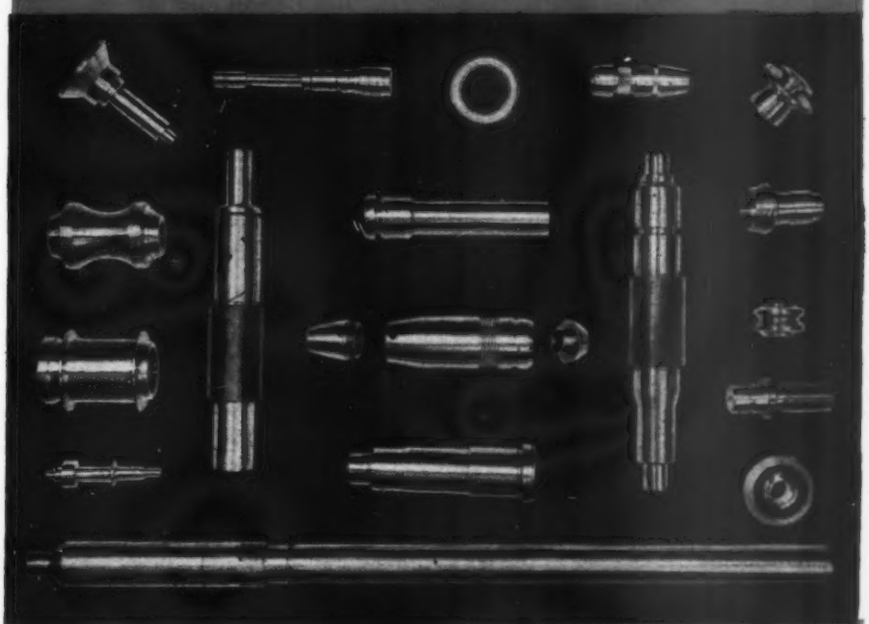
get ready with CONE for tomorrow

A new electrical device analyzes the composition of metal and indicates its maximum endurance. *Electrical Manufacturers Public Information Center.*

get ready with CONE for tomorrow

A new stainless steel is soft and ductile enough to be formed and fabricated like aluminum. *Rustless Iron & Steel Corp., Baltimore.*

Keep ahead with production savings from parts produced on the 8-Spindle Conomatic.

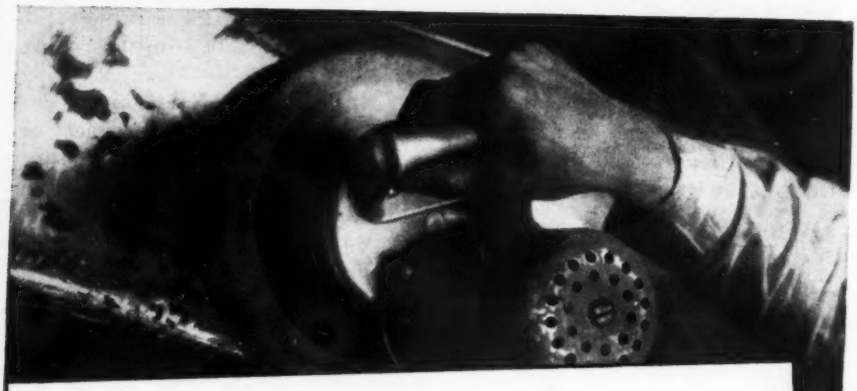


CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U. S. A.

22

THE NEW CEMENT BOND on WELDISKS makes Bulldogs hang their heads in shame!



SEND THIS COUPON TODAY!

ABRASIVE PRODUCTS, INC.

South Braintree 85, Mass.

You may send us FREE WORKING SAMPLES of your new, improved WELDISKS in the size, with the grit and for the operation specified below.

This permission to send FREE working samples places us under no obligation except to prove to ourselves in a test run that –

(1) The new WELDISK cement bond holds the grit to the backing tighter, and for longer, than any previously used bond. It makes WELDISKS the longest lasting disks ever offered to industry.

(2) WELDISK electric-furnace treated aluminum oxide is the toughest abrasive for this purpose and it cuts faster.

(3) WELDISK double-strength, double-hard fibre, laminated with specially treated cloth, prevents edges from going flabby, the fibre from cracking and assures safety from flying particles.

Size of free sample disks should be .....

Grits should be .....

(All grits from 320 to 16 available)

Samples will be used to .....

.....

Shipment should be addressed

Name .....

Company .....

Street and Number ..... *City* ..... *State* .....

Abrasive Products, Inc.

SOUTH BRAINTREE 85 MASSACHUSETTS · MAKERS OF JEWEL COATED ABRASIVES

LABOR DEVELOPMENTS (continued)

the weekly pay as long as weighted average hourly rates of the employees remain below or at bracket levels or where the hours eliminated were "idle" hours spent by the employees in waiting for business to begin. (Six Houston, Tex., Bakeries, WLB; Employers Assn. of Southern Nevada, RWLB-X)

* *Incentive Plan Approved*

WLB approved an incentive plan for non-production or indirect workers based on the dollar value of goods made ready for shipment during a given period. In approving the plan the board ordered certain modifications aimed at relating bonus earnings to efficiency of the workers as closely as possible under the formula established.

* *Incentive Guarantee Ordered Continued*

Discontinuance of an incentive guarantee was disallowed by the WLB on the ground that such would be tantamount to a wage reduction in violation of the Wage Stabilization Act. The guarantee had been instituted at a time when the incentive system was in the experimental stage and was now, in the company's opinion, no longer needed, since the system was perfected and employees would not lose production because of conditions beyond their control. (Curtiss-Wright Corporation, WLB)

* *Discontinuance of Bonus Permitted*

Discontinuance of an attendance bonus was permitted by the WLB where it was shown that the need for it no longer existed on resumption of a six-day work week. The company admitted that the bonus had not proved effective in curbing absenteeism. (Armstrong Cork Company, RWLB-III)

Reinstating a Discontinued Premium

The fact that premium payments were instituted by the company without WLB approval is no defense for their discontinuance on the company's own initiative. Although these payments proved to be excessive and unstabilizing, the regional war labor board ordered the company to make retroactive payments to its employees from the date of the discontinuance. Having fulfilled this monetary obligation, the company could then negotiate with the union for a more reasonable adjustment that complies with wage stabilization. (Dairymen's Association, Ltd., Territorial Bd.—Honolulu, T. H.)

* *Substandard Adjustment Ordered*

Despite the existing high wage level in the industry in the region, a RWLB awarded an 8-cent substandard adjustment to laundry workers in the Galveston area to bring the minimum rate up to 40 cents an hour. Dissenting members pointed out that an incentive system would prove more economically sound. (Galveston Model Laundry, RWLB-VIII)

* *Travel Time*

Indicative of the wide discretion enjoyed by the board in allowing travel time is the grant, in one case for two hours each day to employees temporarily borrowed from

BACK TO "Civies"!

And, as far as G.I. Joe is concerned . . . *but fast!*

And it's back to " civies " for all industry, too, as the nation gets ready for the peacetime change.

We at Levinson Steel, proud of our reputation for dependability and service, have already "changed clothes." We've rolled up our sleeves and are ready to go to work. We're prepared *now* to handle your inquiries for warehouse and fabricated steel.

'Phone, wire, write!

THE LEVINSON STEEL CO.

Warehousers—Fabricators

PITTSBURGH, PA.

LS-3-A

FEDERAL ELECTRIC PRODUCTS COMPANY, INC.
50 Paris Street, Newark 5, N. J.

Yes! . . . I want a copy of the FEDERALOG

Name and title.....

Company .....

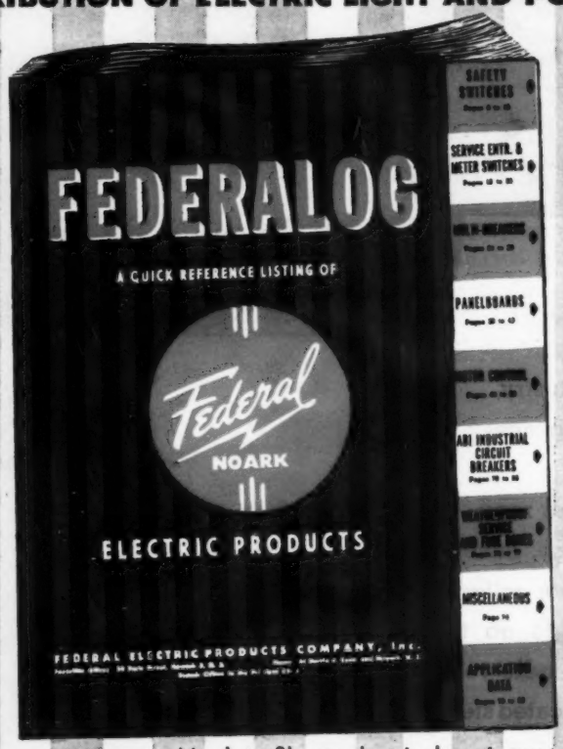
Address .....

☐ Please place my name on your mailing list for all future material

THIS COUPON WILL BRING YOU YOUR COPY OF THE

FEDERALOG

ONE OF TODAY'S MOST IMPORTANT CATALOGS ON EQUIPMENT FOR THE CONTROL AND DISTRIBUTION OF ELECTRIC LIGHT AND POWER



• No data file on electrical equipment is complete without a copy of the FEDERALOG . . . a dependable guide to the newest developments in Motor Controls, Safety Switches, Circuit Breakers, Service Equipment, Panelboards and Multi-Breakers.

FEDERAL ELECTRIC PRODUCTS COMPANY, INC.

EXECUTIVE OFFICES: 50 PARIS ST., NEWARK 5, N. J. • PLANTS: HARTFORD, CONN. • NEWARK, N. J.

another plant who had to drive 30 miles to work each morning and 30 miles back in the evening, and the denial in another for 15 minutes from the plant gate to their working place. (Northland Ski Manufacturing Company, WLB; E. I. du Pont de Nemours & Company, WLB)

Vacation Pay

To equalize SSU with WLB policy the commissioner of internal revenue has issued a rule providing that where employees under the jurisdiction of the War Labor Board are allowed payment of vacation pay, or pay in lieu of vacation on the basis of a work week in excess of the current work week, a similar amount may be approved for salaried employees under the jurisdiction of the bureau.

Prorated Vacation Denied

Reversing a regional board's award of prorated vacation, the WLB announces that its standard one-for-one and two-for-five vacation plan does not contemplate prorated vacation benefits. (Zephyr Manufacturing Company, RWLB-X)

Sick Leave Plan Denied

WLB will not order a sick leave plan even though it be the prevailing industry area practice unless there are special circumstances to justify departure from the general rule (i.e., that they are not to be ordered in dispute cases). Among the special circumstances considered by the board are the peculiar hazards inherent in the nature of the work. (Melville Shoe Corporation, WLB)

** Severance Pay Disapproved*

Stabilization director disapproved a severance pay proposal covering a plant which has already experienced layoffs and is expected to shut down completely within the next few weeks, where it was established that the plan would have added $2,210,000 to the government's bill under a cost-plus-fixed-fee contract with the company. (U. S. Cartridge Company)

Violation of Hiring Limitation Penalized

Because it was the "second offense," a RWLB imposed the maximum penalty on a company for hiring help at above the approved rates. The board recommended the disallowance of the total amount of illegally paid wages as a business expense for income tax purposes. In ordinary circumstances, only a portion of the illegal wage payments is recommended for disallowance. (Charles Hellmuth Printing Ink Corporation, RWLB-II)

NATIONAL LABOR RELATIONS BOARD

** Management's Right to Free Speech*

Recognizing the constitutional guarantee of free speech, the National Labor Relations Board ruled that management was not guilty of unfair labor practice because of a

We took the JARS out of Jar Conveyors!

① BREAKAGE AND SPILLAGE headaches have been cured by the chain belt conveyor that travels as smoothly as a table top . . . Rex Table Top. Jerky, bumpy conveyors that jarred and broke containers are a thing of the past.

② FOR EXAMPLE, the jars that ride on this Rex Table Top conveyor chain glide smoothly along, never jamming, never hesitating, never breaking or spilling. Perfectly flat, with bevel-edged links, Table Top never catches or "trips" containers at transfer points . . . slides freely from under blocked containers, preventing pile-ups, spillage and breakage.

③ SIMPLE DESIGN IS THE SECRET of Table Top's success. It's a one-piece platform link with a simple pin connection. Fewer parts mean less chance for chain trouble, greater steadiness. There are no attachments to break loose or "wobble." It stays cleaner! There are no pockets to catch and hold dirt. Driving sprockets engage the full width of the hinged joint for smooth action, greater bearing area, and long life.

* * *

Rex Table Top is the answer to any problem involving the conveying of bottles, jars or cans. The Rex Man will help you with your chain belt application problems. For complete information on Rex Table Top, write for your copy of Bulletin No. 464. Chain Belt Company, 1667 West Bruce Street, Milwaukee 4, Wisconsin.

REX CHAIN BELTS

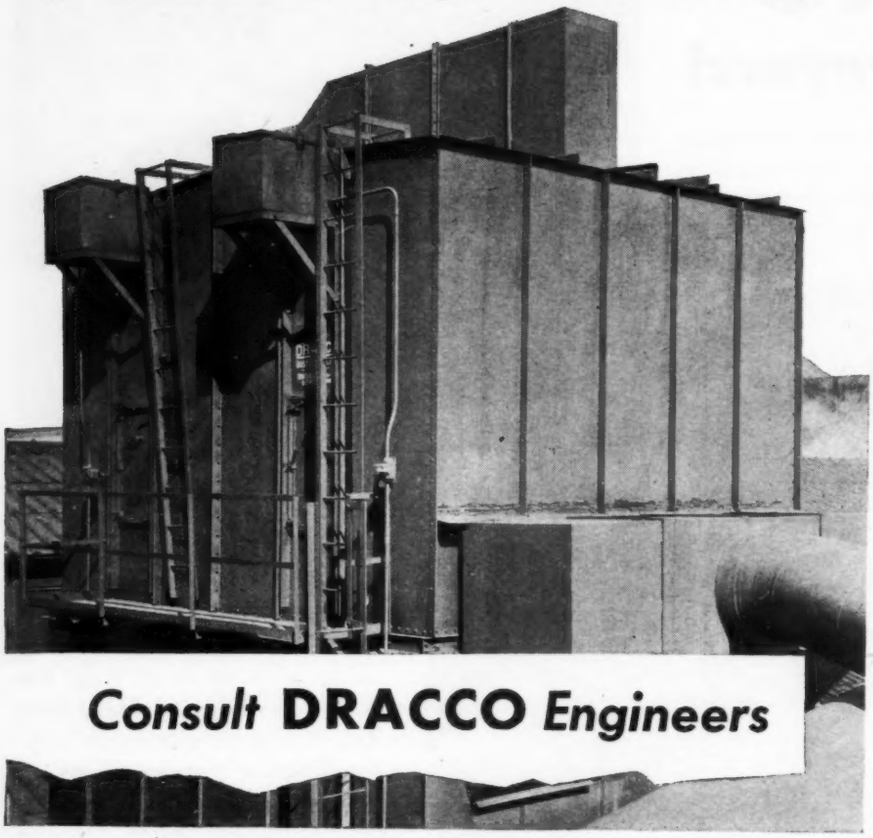
Manufactured in every available type for the positive transmission of power, timing of operations and conveying of materials

CHAIN BELT COMPANY OF MILWAUKEE

Rex Chain Belt and Transmission Division, Rex Conveyor and Process Equipment Division, Milwaukee 4, Wisconsin • Baldwin-Duckworth Division, Springfield 2, Massachusetts

A DUST-FREE PLANT

produces Cheaper and Better



Consult DRACCO Engineers

In the face of severe competition a DUST-FREE plant has the advantage over a plant struggling with a dust hazard. One outstanding fact is that dust ALWAYS causes a loss and that DRACCO Dust Control ALWAYS saves money. DRACCO Dust Control provides better working conditions — by eliminating dust, equipment lasts longer and requires less maintenance. Everything else being equal, a DUST-FREE plant produces cheaper. DRACCO Engineers have over 30 years experience handling dust problems of every description. Why not consult them?

For Further Information Write

DRACCO CORPORATION

4091 E. 116th St., Cleveland 5, Ohio *New York Office: 130 W. 42nd St.*

DUST CONTROL EQUIPMENT

PNEUMATIC CONVEYORS • METAL FABRICATION

supervisor's pre-election remark that he would check up those who voted at the election. Whatever coercion was effected by the remark was held to have been dissipated by the employer's letter urging all employees to vote. (Libbey-Owens-Ford Glass Company, NLRB)

* *Management's Right*

Discharge of an active union member for conducting mass meetings during rest periods to attack and ridicule the company, and for reporting to work late with the excuse that he had been distributing leaflets, was deemed within the prerogative of the employer. The worker involved failed to heed warnings and other disciplinary measures taken prior to his discharge. (Fafnir Ball Bearing Company, RWLB-I)

* *Notice of Rival's Claim Waived*

Provision in a renewable contract for a 14-month notice period was held "unduly long" by the NLRB. Accordingly, the board waived the requirement that a rival union notify the company of its claim to a majority before the effective date of the automatic-renewal notice in the existing contract. On the ground that the 14-month period was not compatible with other contracts in the industry, and that the rival union did give 2 months' notice, the board declared the contract no bar to a representation election. (Toledo Edison Company, NLRB)

* *No Domination*

Employer approval of the conduct of an inside union does not of itself constitute grounds for charging the employer with union domination. In the case involved, the board found the union had been formed by the action of its own members but that cordial relations existed between the union and employer. Nor did the fact that the employer contributed to the union's social functions tint the employer's actions since such contributions were made only after the union had established itself, and were not of such a large amount as to mean the failure or success of the union's social functions. (Mallinckrodt Chemical Works, NLRB)

* *Delayed Election Unjustified*

Mere reduction of an employer's working force does not constitute valid reason for delaying the determination of a bargaining representative unless the reduction encompasses a material change in the appropriate bargaining unit or new or materially different operations or processes. In one case, the employer urged a delay until the new operations were instituted. The board denied the request on the ground that the reduction in number of workers did not change the nature of the unit but merely its size. (Reliable Nut Company, NLRB)

* *Held Domination*

The so-called "multiple management plan," whereby a senior board of directors chosen by the stockholders was established with a subsidiary manufacturing board (composed of members from the factory originally chosen by the board of directors and later elected by the employees), was deemed a

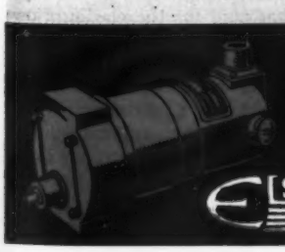
● Jobbers who have not already placed their quantity commitments for SPRAYIT Paint Spraying Equipment are urged to do so immediately. Orders will be filled just as fast as production conditions permit and in the order in which they are received. DEALERS are asked to keep in touch with their Jobbers regarding expected initial delivery dates. If you do not know the name and address of your nearest SPRAYIT Jobber, write and we'll gladly send this information to you at once.

SPRAYIT

PAINT SPRAYING EQUIPMENT, AIR COMPRESSORS, SPRAY GUNS, PUMPS, AIR TOOLS, INSECTICIDE SPRAYERS, SANDERS AND ALLIED FINISHING EQUIPMENT.

ELSCO

ELECTRIC MOTORS, GENERATORS, VALVES, PUMPS, HYDRAULIC CYLINDERS AND CONTROLS FOR AIRCRAFT, AUTOMOTIVE AND OTHER INDUSTRIAL APPLICATIONS



ELECTRIC SPRAYIT CO.

SHEBOYGAN, WISCONSIN

ELSCO SPRAYIT

THE NAZIS HAD

A WORD FOR IT

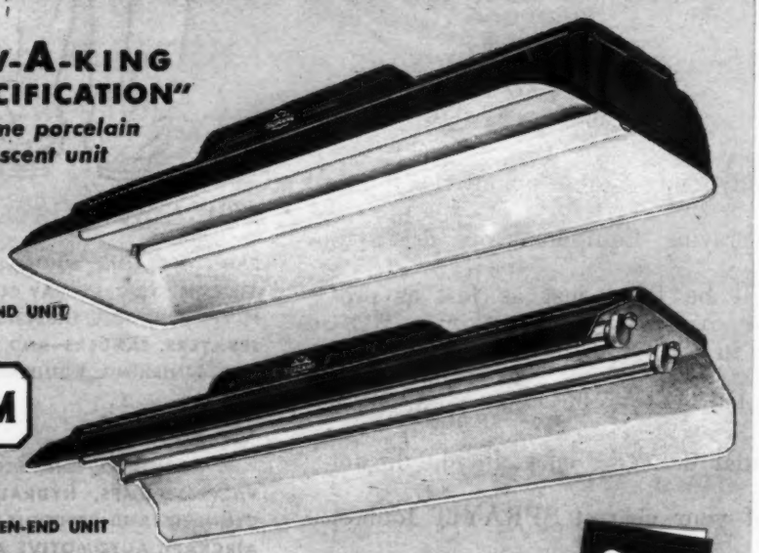
Ersatz!

Not so long ago, lighting fixtures were made of various substitutes, held together with scarcely more than a prayer.

Some lighting products, we're told, are still made that way. But not SILV-A-KING products! Ever since Uncle Sam gave us the nod, nothing but the best of pre-war (and post-war!) materials and engineering have gone into SILV-A-KING fixtures. That's why today's SILV-A-KING fluorescent fixtures are drawn one-piece and seamless of heavy gauge steel, have a porcelain-enamel finish that will maintain initial reflectivity *and last for a lifetime*. That's why SILV-A-KING fixtures embody a host of important construction features that make for better performance ... improved appearance.

SILV-A-KING "SPECIFICATION"

Lifetime porcelain fluorescent unit



CLOSED-END UNIT

RLM

OPEN-END UNIT

Nothing "ersatz" about this bulletin! It's No. 45FS, fully describing the "Specification" model in both open and closed types.

SILV-A-KING LIGHTING EQUIPMENT

BRIGHT LIGHT REFLECTOR CO.

INC.

Metropolitan & Morgan Aves., Bklyn. 6, N. Y.

LABOR DEVELOPMENTS (continued)

dominated labor organization by the board. Since the plan called for settlement of grievances through the boards, it was deemed a labor organization, and since no general meetings were held, no membership dues collected, elections for representatives were held on company property, and committed members were compensated and allowed to use company property, the organization was banned as dominated. (Jas. H. Matthews & Company, NLRB)

* *Injunction Granted*

An injunction was issued by a state supreme court restricting mass picketing of a movie studio on the ground that the union used intimidation and coercion rather than persuasion. The court recognized the right of the union to picket as a means of advertising its side of the dispute, but it held that restraint was warranted where the picketing was conducted through a congregation of a large number of pickets massed in front of the plant obstructing entrances, and use was made of loudspeakers to threaten persons coming in and out of the plant. (Samuel Goldwyn Studios vs. Screen Set Designers, Calif. Super. Ct.)

* *Injunction Sustained*

The fact that the employers did not first resort to arbitration does not serve to nullify an injunction obtained by a group of employers against a union to prevent the latter from striking in violation of its collective bargaining contract. The union sought to have itself recognized as the representative of a group of workers represented by a rival union. The court explained that the matters in question were unarbitrable and refused to abate the injunction. (Columbia Pictures Corporation vs. Screen Office Employees Guild, Calif. Super. Ct.)

* *Enforcement Through Contempt Proceedings*

Interference with a judicial order requiring an employer to bargain will result in contempt proceedings against the interfering party. In one case, a rival union threatened the employer with a strike should he comply with the court's order to bargain with the certified union. The employer, delaying the bargaining process, requested the court to enjoin the rival union from interfering. The court deemed such action unnecessary, since the injunction against the company also applies to the parties having notice of it. (NLRB vs. National Broadcasting Company, CCA-2)

* *No Right to Higher Pay*

An employee has no right to a higher rate of pay than that paid for the classification to which the union has assigned him, despite the fact that he may perform the work of a higher paid classification. In one case, the court held that the employee, classified by the union as an apprentice, was entitled to receive only apprentice pay even though he performed the work of a journeyman. (Grosso vs. General Bronze Corporation, N. Y. City Ct.)

70%

TIME SAVINGS

with MORRISON Metal Stitching

MODEL SJX
25" THROAT
ARM STITCHER

MAYBE your post-war plans include automotive, refrigeration or heating and ventilating equipment. Possibly you are going to make prefabricated houses, washing machines, furniture, farm implements, luggage, aircraft or *any* products involving fastening problems.

If so, that's where it pays to investigate Metal Stitching as done the Morrison way. These heavy-duty machines effect as much as 70% time savings in assembling steel, aluminum, stainless steel, or other metals. They also fasten woods, fabrics, rubber, plastics or other composition materials to metal or in any combination. Why not get the facts about Morrison Metal Stitching at once! Use the coupon below.

We also manufacture a complete line of book, container and steel stitchers. Sales and Service Representatives in all principal cities in the United States and Canada.

MODEL SJY
25" THROAT
POST STITCHER

MORRISON

PRODUCTS OF THE SEYBOLD DIVISION
HARRIS-SEYBOLD-POTTER COMPANY
DAYTON F7, OHIO

STITCHERS

ARMY E NAVY

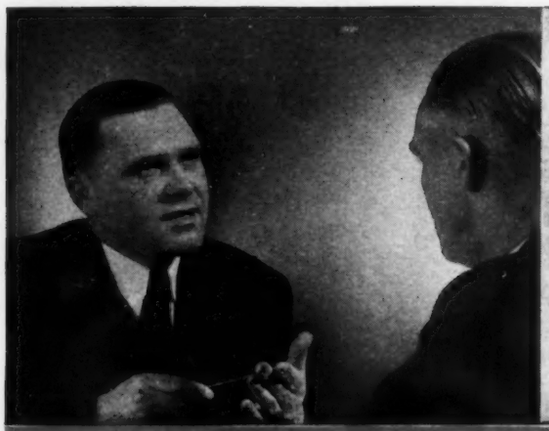
HARRIS-SEYBOLD-POTTER CO., Dept. F-105
819 Washington Street, Dayton, F-7, Ohio

Please send me complete information on your Metal Stitchers.
We Rivet _____, Spot Weld _____, Type and Thickness of Material _____

Name .....

Company .....

City ..... *State* .....

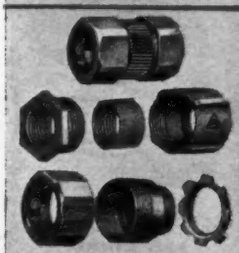


"It's Good, Sound Procedure to Specify—

APPLETON FITTINGS"

Square and Octagonal Outlet Boxes. Below, NEW Type No. 8438R Swivel Fixture Joint and Cover — insures perfect alignment for rows of pendent lighting fixtures.

Couplings and Connectors for Electrical Metallic Tubing.



Couplings and Connectors for Rigid Conduit.

Straight and Angle Connectors for armored cable, flexible conduit, etc.

- COMPLETE LINE for smooth, easy installation
- PRECISION DESIGNED for efficient operation
- RUGGEDLY BUILT for permanence
- PROMPT SERVICE for quick plant-reconversion

OUTLET AND SWITCH BOXES, CONDUIT FITTINGS FOR EVERY SPECIFICATION

Jobs run smoother . . . time and energy are saved . . . safety is stepped up with Appleton Fittings! Made to exacting specifications in Appleton's own foundries and fabricating plants, these tough, durable fittings are outstanding in precision design and high quality.

The complete Appleton line—over 15,000 fittings and fixtures—has an exact type and size for every preference and specification! It assures efficient operation and easy installation.

Over 41 years of leadership in practical design and skilled engineering have made Appleton products "STANDARD FOR BETTER WIRING." That's why it's good, sound procedure and farsighted planning to specify Appleton Fittings for every conduit job.

Sold Through Wholesalers

APPLETON ELECTRIC COMPANY

1715 WELLINGTON AVENUE • CHICAGO 13, ILLINOIS

14 Branch Offices and 7 Resident Representatives in All Principal Markets

Guy Wire Hanger Unilet with rod support and pendent fixture hook.

APPLETON ELECTRIC PRODUCTS

APPLETON

CONDUIT FITTINGS • OUTLET AND SWITCH BOXES • EXPLOSION-PROOF FITTINGS • REELITES

How to Sell a Training Program

WALTER DIETZ, Associate Director, Training Within Industry Service, War Manpower Commission, Washington, D.C.

Sound training programs can be sold to management, but sometimes they aren't. Why? If we look at only the ones which deserve to, but don't, get attention, we have to conclude that the fault lies in the approach that is used.

Of course, poor programs do not deserve adoption but we are ruling those out and giving attention only to those which are truly planned to meet current plant production needs.

There are two major reasons why proposals for new training programs are turned down:

1. If the training man has a past record of having promoted generalized programs which are unconnected with plant problems—that is, if he has kept training going whether or not there is any real need but just because "there ought to be some training"—he will find it hard to get anyone to even listen to him when times are busy, or profits are lean. Unfortunately many a training man has let his management get the idea that training is "good for our employees" and thereby let them miss the fact that training is a management tool.

2. If the training man talks techniques and *how* he will operate his program, a well-designed plan may never be connected by management with any current plant problem.

With the first of these reasons—training for training's sake—we are not concerned here, but we are going to take up the problem of the man who has a good program, designed to meet acute, existing needs, but who talks about what he's going to do, instead of what his plan will do.

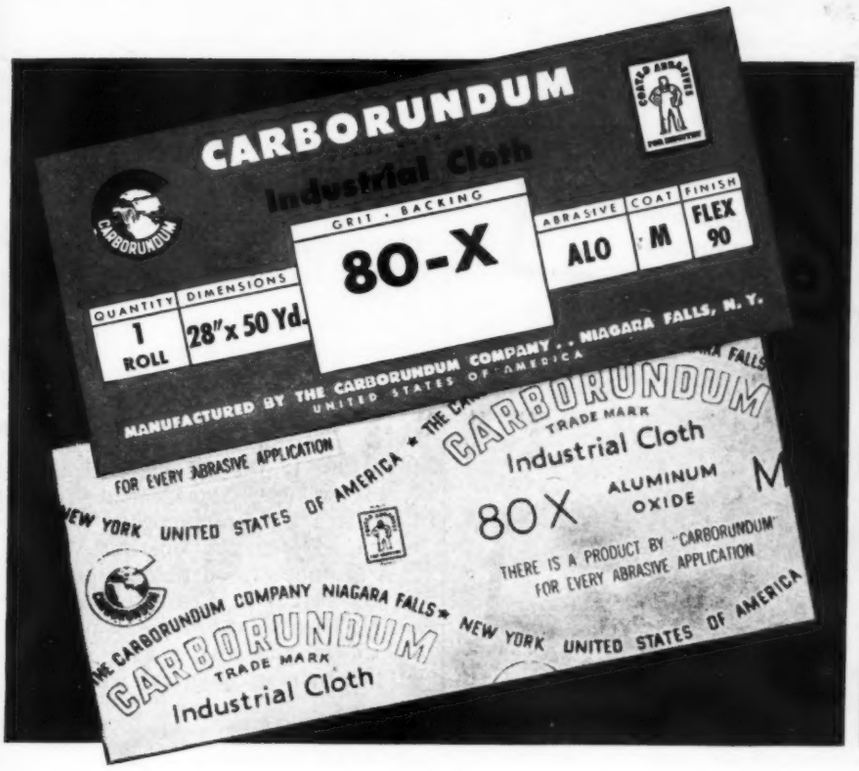
We know that top executives are interested in results, not means; in accomplishments, not techniques. Management is management because it has to get out production in spite of turnover, scrap, waste, rejects, poor use of machines, time, high costs. Therefore, management is interested in those problems.

Relatively few managers are interested in whether real machines, models, cutaways, or motion pictures are the best means of familiarizing a supervisor or a worker with a new operation, —but many training men stake their plans on discussing such techniques.

The person who has something to sell has to talk in terms of what people will buy.

Is top management interested in

NOW IT'S EASY TO IDENTIFY COATED ABRASIVES BY "CARBORUNDUM"



"CARBORUNDUM" has put its simplified identification system for coated abrasives into effect. Now it is easy to order these products. First the product is called by its right name—the name of the end use. Second that name and the specifications appear on *both* the package label and the backing material. The man in the shop can easily tell what he is using and requisition more. The stockroom finds it quicker and easier to locate the requisitioned material. The purchasing department eliminates trouble in duplicating previous orders. For complete information, please refer to our new, authoritative coated abrasives book, "Sanding & Finishing." If you have not yet received your free copy, please write The Carborundum Company, Niagara Falls, New York.

THERE IS A PRODUCT BY

CARBORUNDUM

TRADE MARK

FOR EVERY ABRASIVE APPLICATION

("CARBORUNDUM" is a registered trade mark of and indicates manufacture by The Carborundum Company)

Tops in Protection

YOUR property certainly rates the best protection against unwanted visitors that you can provide, so why not let our trained engineers check your needs and make recommendations. You'll be under no obligation.

Cyclone Fence, Gates, Window Guards and Wire Mesh partitions have proved their value in thousands of plants of every type. Cyclone has many advantages. It is built by experts to give long, satisfactory service. Its many special features include posts that stay straight, rails that don't buckle, gates that don't sag. Long recognized as the leader, U·S·S Cyclone is the world's most widely used property protection fence.

You'll find our big, 32-page fence catalog a valuable reference book. Crammed with pictures, facts and specifications covering many styles of Cyclone Fence, Gates and other property safeguards. Whether you need a few feet of fence or several miles of it, you should have this useful book. It's free. Write, or mail the coupon.

CYCLONE FENCE DIVISION
(AMERICAN STEEL & WIRE COMPANY)
Waukegan, Ill. · *Branches in Principal Cities*
United States Steel Export Company, New York

U·S·S CYCLONE FENCE

CYCLONE FENCE DIVISION · American Steel & Wire Co. · USS CYCLONE FENCE · UNITED STATES STEEL

Clip this coupon—and send it to:
Cyclone Fence, Waukegan, Ill., DEPT. 905
We'll send you our free, 32-page book on fence. It's full of facts, specifications, illustrations. Shows 14 types of fence. Before you choose any fence for your property, get the facts about Cyclone. Mail this coupon today.

Name.....
Address.....
City..... State.....
Interested in fencing: ☐ Industrial; ☐ School; ☐ Playground; ☐ Residence. Approximately.....feet.

UNITED STATES STEEL

costs—present a plan for reducing costs. And you must remember that your training plan *is* only a means—your design, your objective, your promised results all point toward cost reduction. Some bosses will want to know what your proposed plant itself will cost—be ready with exact information.

Are executives concerned about products that fail to pass inspection, about goods that customers are rejecting (that they won't buy or that they return as faulty)? Talk in those terms.

Is the boss worried about meeting a contract on time or setting a good enough record that he'll get another? Get down to facts on exactly how the plant meets or doesn't meet its orders.

Is the plant concerned about its local standing—about whether the plant is considered "a good place to work?" Put your proposals up in that language.

In other words, talk in terms of what is already a matter of management concern.

How to Get Support

Interest is not enough, acceptance is not enough. Management has to take part if a training program is going to be adopted *and* operated.

A genuinely good training program means, of course, that line operating people have identified problems, have helped to plan the specific content of the training programs which will overcome the underlying causes of problems, and are ready to assist in the actual training.

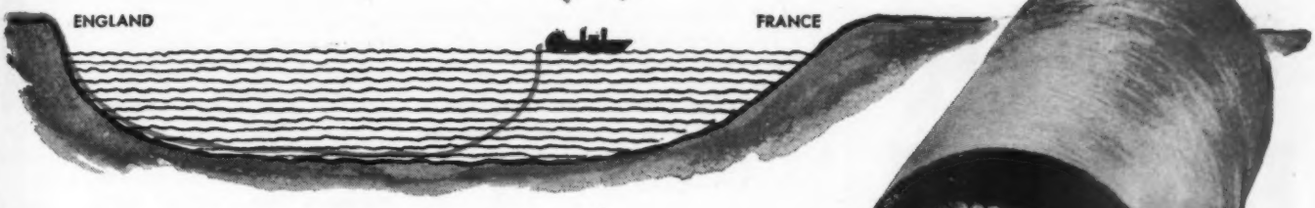
But passive acceptance at the top of management, indifference at the middle levels—both of these can nullify thoroughly good planning of training.

It is necessary for the training man to do such good work that he is ready to really promise results in tangible terms—money, quality, time, manpower—that he gets not merely support but a management demand that the plan be used and the expected results produced.

Work with production people—get their problems. In designing a plan to help them overcome the causes of a problem, get them to supply "*what* their people need to know"—you supply "*how* the people can acquire the necessary knowledge or skill."

Talk to management in terms of the problem, the specific evidence, the expected results. Subordinate training techniques. Sell the results hard enough that management will demand them. Then, and only then, will the training plan really be accepted as an operating tool.

"OPERATION PLUTO" ...pipe line to Victory!



Large quantities of American Quality Cold Rolled Strip and Galvanized Wire were used to armor the secret "Pipe-Line-Under-the-Ocean" that powered the victory in Europe.

BRITAIN'S gasoline pipeline network laid under the English Channel to fuel the push to Berlin was one of the best kept secrets of the war. It ranks as among the most amazing engineering feats ever accomplished.

This project, originally suggested by Admiral Lord Louis Mountbatten, was first declared impossible. But—shortly after D-Day special cable-laying ships steamed slowly across the Channel and in 10 hours had unreeled the first of four lines that run 66 miles from the Isle of Wight to the tip of Normandy at Cherbourg. Together with sixteen lines later laid under the Straits of Dover to Boulonge they were delivering to the fighting forces a million gallons of gasoline per day. Tied into land lines they permitted a flow of fighting fuel from Liverpool to the Rhine.

140 miles of this cable pipe—built like a submarine electric power cable but without core or insulation—were manufactured by four firms in America. Turned out in 26,000 ft. lengths, the pipe is 3 in. in diameter, is capable of withstanding a pressure of 1200 p.s.i.

American Steel & Wire Company was called on to participate because of our ability to furnish, promptly and in quantity, armoring tape of fully annealed bright Cold Rolled Strip and Extra Galvanized Armor Wire to the high physicals and close tolerances demanded.

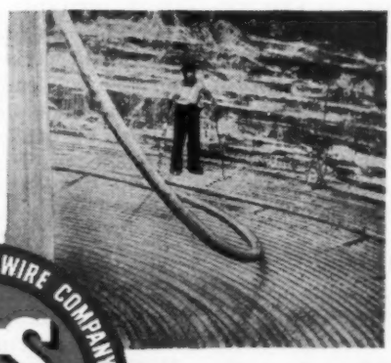
Over an extruded lead core, 3.07" I.D., with walls .185" thick, coated with asphalt were wound two asphalt paper tapes and a vinylite resin tape. Over this were wound four armoring tapes of *U·S·S American Quality Cold Rolled Strip* 2" wide and .024" thick having a tensile strength of 56,000 p.s.i. min. and yield point of 45,000 p.s.i. min. Next came an asphalt sheathing and a roving of jute fibres to cushion an armor of 57 strands of *U·S·S American Galvanized Armor Wire* .192" diam., which were wound on as in a submarine cable forming operation and set in asphalt during winding. A final outer padding of jute and asphalt, coated with whiting to provide a non-sticky and heat reflecting surface completed the job.

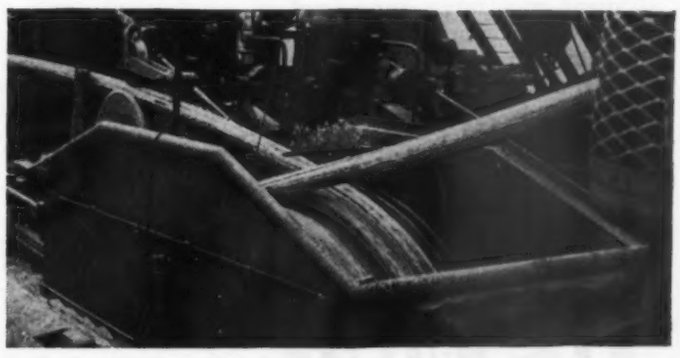
This pipe, designed to withstand internal pressures up to 2500 p.s.i., was tested at pressures up to 3600 p.s.i. with no evidence of leakage or distortion.

AMERICAN STEEL & WIRE COMPANY
Cleveland, Chicago and New York
Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

UNITED STATES STEEL

Photographs show cable "pipe" in the hold of the Liberty ship "Latimer" — one continuous length for the entire channel crossing. The picture of the pipe passing round the cable drum illustrates its flexibility.

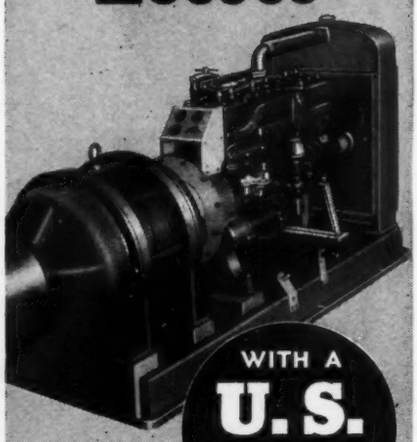




AMERICAN STEEL & WIRE COMPANY USS STEEL UNITED STATES STEEL

U·S·S American *Quality* Cold Rolled Strip

Insure Against POWER FAILURE Losses



WITH A U.S. STAND-BY ELECTRIC PLANT

It is wise to safeguard electric ovens, furnaces, electrolytic processes and other crucial operations with stand-by service to avoid losses of power failure.
We specialize in the building of this type of Emergency Electric Plant equipment and have successful installations in varied applications throughout the nation.
Write for specific details.

UNITED STATES MOTORS CORP.
552 Nebraska St. Oshkosh, Wis.

The U. S. line includes Gasoline and Diesel Units up to 75 KW.

U.S. ELECTRIC PLANTS
FOR STAND-BY SERVICE

THEY SAY AND DO

The Labor Crisis

(The following editorial appeared in "The New York Times")

As a sudden rash of strikes and of extravagant wage and hour demands bursts out simultaneously in a score of industries, Washington officials hurriedly gather to discuss additional "labor machinery." One "labor relations expert" is quoted as declaring that "an Administration that prides itself on planning has never planned its labor relations."

But it is strange to accuse Congress and the Truman Administration of having no labor machinery, no labor "planning," and no labor policy. The basic difficulty is rather the opposite. It is the existence of too much overlapping and conflicting labor machinery. It is not the absence of a labor policy that has done most to bring about the present crisis; it is the existence of a labor policy based chiefly on political expediency.

It was a spokesman for the Truman Administration, William H. Davis, the Director of Economic Stabilization, who announced that Administration policy would be to boost wages and keep down prices. He went on to support this policy with the remarkable doctrine that wages were not an important element in prices. The unions have not been slow to take the Administration at its word. As Walter P. Reuther, the vice-president of the United Automobile Workers of America, writes to the president of the General Motors Corporation, "with this (Administration) policy we in the UAW-CIO are in hearty accord. We have maintained all along that the public interest demands effective, stringent price control. . . Our demand (for a 30 percent increase in present scheduled hourly wage rates) is made with the knowledge that it will not necessitate any price increases."

Political responsibility for the present outbreak of strikes and demands goes back farther than this. All during the war period, when the War Labor Board, under Davis, was ordering wage increases, it kept insisting that in relation to increased prices the increase in weekly take-home wages should be ignored. It also ignored the increase in average hourly earnings and even the increase in average straight-time hourly earnings, to concentrate on one figure for purposes of measuring labor's position. This was basic straight-time wage rates. The unions concurred in this. Their arguments for wage increases consistently ignored the increase in average hourly earnings and the increase in weekly earnings. But now that wages as measured by these last two standards are going down and not up, union leaders wish to reverse the process. The weekly take-home wage, ignored on its way up, suddenly becomes the crucial figure. Union leaders wish now to freeze it at its wartime peak. But while basic wage rates during the war increased from January, 1941, by only 20 percent, average hourly earnings increased 53 percent, and average weekly earnings 77 percent. It is this last increase that important unions are trying to freeze, though in the same period the government figures show an increase in the cost-of-living index of only 28 percent.

The Contribution of Congress

Meanwhile Congress has been making its own contribution to the present crisis through the Connally-Smith Act. This act, in effect, did nothing to penalize striking, though it penalized the companies struck against by providing for government seizure of their properties. As a positive contribution, the act contained a provision forcing the government in wartime to take strike ballots among employees at the taxpayers' expense. Reuther now plans to make use of this provision. He has told reporters that under the terms of the law he will petition the federal government to take strike votes in a hundred General Motors plants.

As a further federal contribution toward the present situation, we must not forget the Wagner Act. This act, in addition to promoting unionization, specifically sanctions strikes. It also, in effect, prevents employers from discharging strikers and hiring other permanent workers in their places, and so deprives employers of the chief weapon they previously possessed in combating strikes. Finally, the Supreme Court has declared that labor unions enjoy sweeping immunities, under Congressional laws, from the anti-trust and anti-conspiracy laws that apply to everyone else.

Whether one approves of all these measures or not, they cannot be called a lack of governmental labor policy. With the War Labor Board, the National Labor Relations Board, the railway and other labor boards, and Department of Labor, we cannot be said to have a lack of governmental labor machinery. The real question is whether we have been following the

FOR RUST PROTECTING
STORED WAR MACHINES...USE

H.R.P.* Service

Personalized aid...plus proven Cosmoline products

This Houghton service includes not only the supplying of the necessary approved specification products prescribed by government agencies.

It goes much further, offering the personal assistance of trained engineers working constantly on packaging problems. Back of them is the Houghton Research Staff of technical men available for special needs.

Houghton also offers free digests of current corrosion preventive specifications, including P. S. 300-4, and of the SWPA Space Control Committee's "Guide for the Storage of Plant Equipment." Thousands of copies of each of these helpful pocket-size booklets have already been distributed.

When storing war machines, use this service, and use Houghton's COSMOLINE, available promptly in many grades and types to help combat corrosion. E. F. HOUGHTON & CO., 303 West Lehigh Avenue, Philadelphia, and all principal cities.

*Houghton's

RUST PREVENTION SERVICE

HOW TO CUT YOUR TRUCKING TIME

● The one SURE way to cut your trucking time is to put easy-rolling American Hand Trucks into the hands of your truckers!

American Pressed-Steel Hand Trucks cut trucking time because they are easier to use. Proper balance makes the load easier to handle—reduces the load on the trucker. And accurately machined wheels and axles together with alemite lubrication further reduces the effort required to move materials with these hand trucks. All these factors combine to reduce "trucker fatigue" and result in more material moved in less time.

Plan to take advantage of lower hand trucking costs by writing for a copy of the American Pressed-Steel Hand Truck Catalog. It illustrates and describes every one of the 39 types and 60 sizes of these stronger, easier-to-use trucks.

The American Pulley Company

4212 WISSAHICKON AVE., PHILA. 29, PA.

AMERICAN PRESSED-STEEL HAND TRUCKS

right policies or setting up the right machinery. Certainly, the mere existence of more conciliation machinery is not going to solve the problem, and proposals for compulsory arbitration are a move in the direction of totalitarianism. The proposal for a conference of "Labor" and "Management" is a mere evasion of the issue, unless the government has a very concrete program to present for possible acceptance.

What the federal government has to decide now, through Congress and the Administration, is whether it should withdraw from the one-sided labor intervention of recent years, or whether it should attempt to balance out this intervention with a two-sided policy that recognizes union responsibilities as well as union rights.

•

Labor and Management Cooperate for Peace

The usefulness of plant labor-management committees does not have to cease with the cessation of hostilities. One of the first of these committees to "reconvert" to a peacetime basis is that of Pitney-Bowes, Inc., Stamford, Conn.

The "reconversion" is complete, even to a new name—Industrial Relations Council; new insigne (illustrated below); and new charter or statement

INDUSTRIAL RELATIONS

COUNCIL

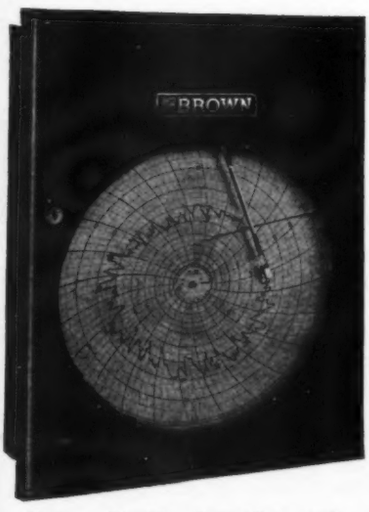
of purposes. Each replaces an official WPB wartime counterpart.

The new name was suggested by a labor member, as better suited to peacetime operations and better descriptive of the greatly expanded program which now embraces even white collar office workers not generally identified as "labor" or factory workers.

The new symbol preserves the basic handclasp of labor-management teamwork, but replaces the government eagle with the company initials, and shows the new council name.

The new council charter states that

Invaluable To Cost Accounting



Brown Electric Recording and Integrating Flow Meter

In the operation of steam boilers—fuel and water are the raw materials which are converted into the useful product *Steam.*

In practically all cases, the cost of fuel represents the major expenditure therefore its conservation is the primary object of maximum boiler room efficiency.

To operate a steam plant efficiently and properly allocate costs, certain quantities must be measured so that an intelligent analysis of performance can be made.

The importance of Brown's Chart Records can not be over emphasized. They shown how much steam is produced and used per fuel dollar expenditure.

The keeping of permanent chart records of temperatures, pressures, flows, liquid levels, etc. is not only considered good management but it is also a modern practice to centralize the measurement of these variables on a main control board. The instruments reveal to the engineer or management any deviation above or below the most efficient operating conditions.

Brown Indicating and Recording Instruments are furnished in standard universal cases, adaptable for any style of panel mounting, they present a uniform and well-balanced appearance.

For information, write THE BROWN INSTRUMENT COMPANY, a division of Minneapolis-Honeywell Regulator Company, 4461 Wayne Avenue, Philadelphia 44, Pa. Offices in all principal cities. Toronto, Canada — London, England — Nybrokajen 7, Stockholm, Sweden—Amsterdam, Holland.

BROWN INSTRUMENTS

AND MINNEAPOLIS-HONEYWELL CONTROL SYSTEMS

For Temperatures . . . . . Pressures . . . . . Flows . . . . . Liquid Levels

Street Car Lifted SAFELY, EASILY, ECONOMICALLY with CURTIS Air Cylinders

✓ The above illustration shows how two giant Curtis Air Cylinders lift an entire street car from its trucks. Air power also allows workmen to clean the motors with a stream of air, as well as paint the car with an air-operated spray gun. Air power handles three operations at once.

Engineered to your individual requirements in a variety of applications—including practically any handling, lifting, pushing, or pulling operations—Curtis Air Cylinders and Curtis Air Hoists are stepping up production, saving time, labor, and cutting costs in many industries today.

Curtis Air Cylinders and Hoists are simple in construction, are immune to abuse from overloads, and can be operated by unskilled labor. They provide these important advantages:

- ✓ Smooth, fast—accurate control of load
- ✓ Low first cost—lowest operating expense
- ✓ Light weight—pendant, bracketed, or rope compounded types
- ✓ One-man or one-woman operated—finger tip control

Hundreds of plants have thus increased efficiency, reduced worker fatigue, saved thousands of man-hours, and solved many a hoisting problem with Curtis equipment. It will pay you to write for Form A-4-B, which gives full information.

CURTIS
ST. LOUIS
NEW YORK
CHICAGO
SAN FRANCISCO
PORTLAND

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

CURTIS PNEUMATIC MACHINERY DIVISION G-445
of Curtis Manufacturing Company
1995 Kienlen Avenue, St. Louis 20, Missouri
Please send me Form A-4-B.

Name.....
Firm.....
Street.....
City.....Zone.....State.....

the peacetime labor-management committee "seeks to serve labor with increased job security and satisfaction in working conditions and earning opportunities," and to serve management "with a broad pooling of ideas, and the development of a high degree of teamplay in turning out better products at lower costs for wider distribution."

There are four plantwide special activity committees, including those for safety, suggestions, production progress, and the incentive system. All committees have equal representation of labor-elected and management-appointed members.

In addition, labor members of the new council now attend regular monthly meetings of the company's general executive staff. They participate in discussions, make recommendations, and receive first-hand information on the company's financial, production, and sales progress.

•

How Long Will Unemployment Last?

(Reprinted from The Cleveland Trust Company "Business Bulletin")

Large scale unemployment is beginning to develop in this country. It cannot be avoided, but its results need not be very serious if only we and our legislators recognize it for what it is and exercise restraint in dealing with it. The most important fact for all of us to remember is that it will not be depression unemployment, although it will look like it, and to many individuals it will feel like it. It will be a very special and only temporary form of being cut out of work which the economists term frictional unemployment.

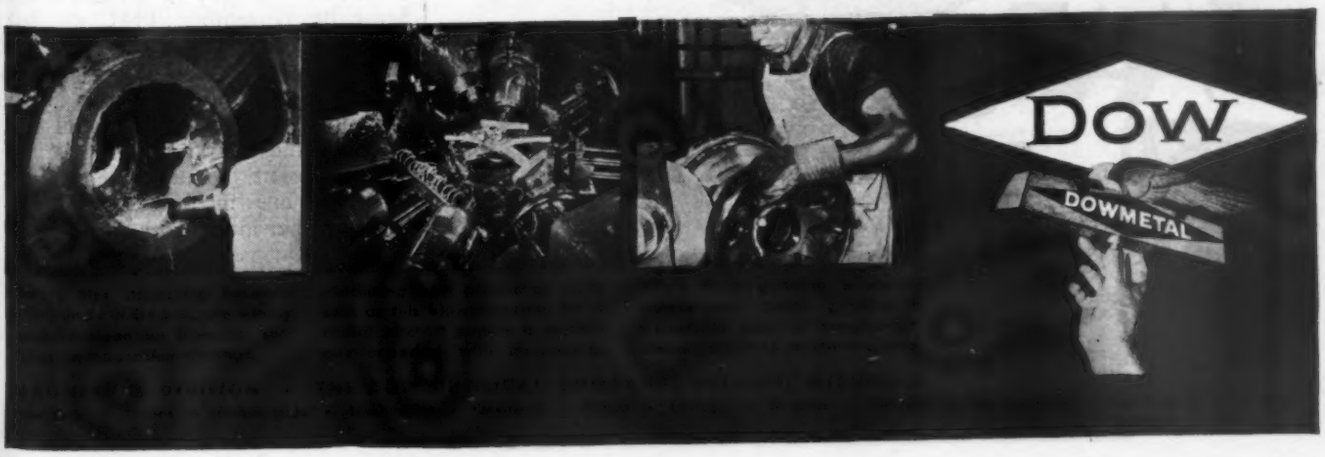
We have 12,000,000 people in the armed forces, and until very recently we have had about 12,000,000 more working at munitions making, or in the war agencies, and in other related wartime occupations. Most of these 24,000,000 people will have to find occupations different from those in which they have been engaged, and a great majority of them must find their new jobs in places other than those in which they have been located. The result will be a huge shifting about from job to job and from place to place, and consequently much frictional unemployment, not caused by lack of demand for workers but by temporary large-scale readjustments between and among workers and jobs.

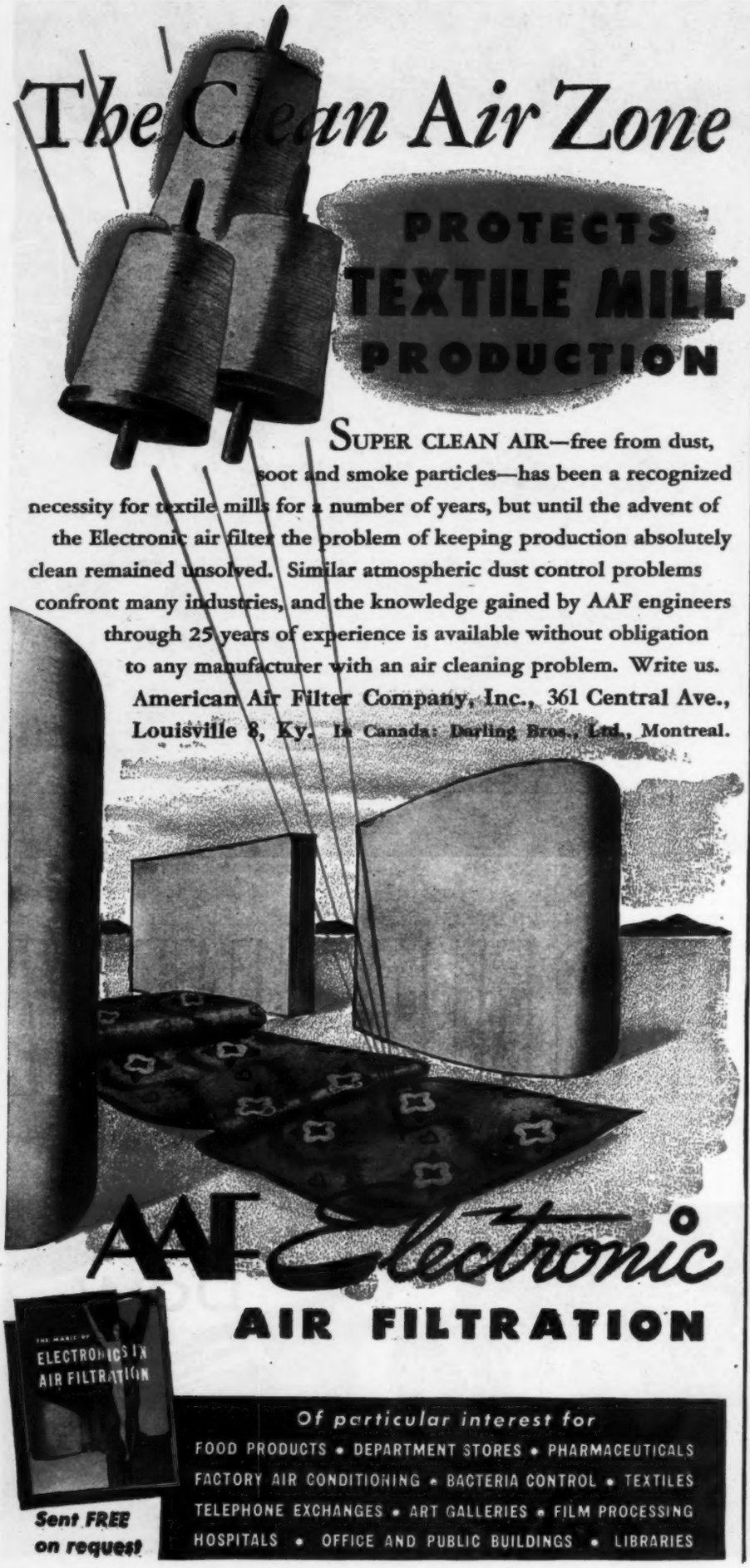
New laws cannot help much in

Ready... to make products move!

MAGNESIUM

LIGHTEST OF ALL STRUCTURAL METALS




The Clean Air Zone
PROTECTS
TEXTILE MILL
PRODUCTION
SUPER CLEAN AIR—free from dust, soot and smoke particles—has been a recognized necessity for textile mills for a number of years, but until the advent of the Electronic air filter the problem of keeping production absolutely clean remained unsolved. Similar atmospheric dust control problems confront many industries, and the knowledge gained by AAF engineers through 25 years of experience is available without obligation to any manufacturer with an air cleaning problem. Write us.
American Air Filter Company, Inc., 361 Central Ave., Louisville 8, Ky. In Canada: Darling Bros., Ltd., Montreal.
AAF Electronic
AIR FILTRATION
ELECTRONICS IN AIR FILTRATION
Sent FREE on request
Of particular interest for
FOOD PRODUCTS • DEPARTMENT STORES • PHARMACEUTICALS
FACTORY AIR CONDITIONING • BACTERIA CONTROL • TEXTILES
TELEPHONE EXCHANGES • ART GALLERIES • FILM PROCESSING
HOSPITALS • OFFICE AND PUBLIC BUILDINGS • LIBRARIES

dealing with the problems of frictional unemployment. They cannot be solved by a full employment law. Programs of public works will afford little help. Increases in unemployment compensation make unemployment easier, but the need is for measures to make employment easier. Two sets of such measures are appropriate and available, and they are very simple. One consists of increasing the numbers of the offices of the United States Employment Service, and improving their facilities. The other is to make tires widely available just as soon as possible so that workers seeking jobs can hunt for them.

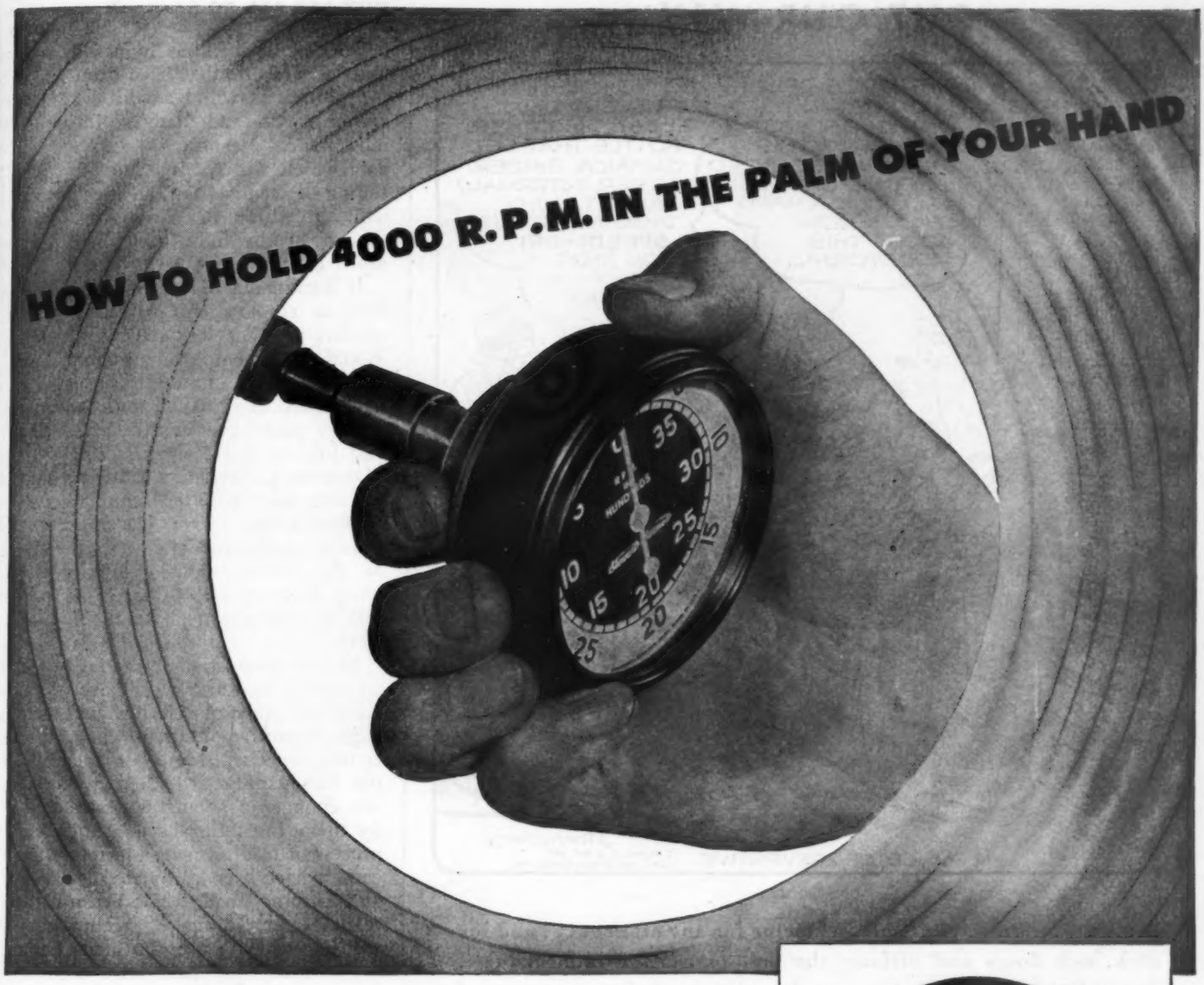
Already great progress has been made in the prompt removal of restrictions, controls, regulations, and ceilings which were imposed to govern wartime production, but which would limit and handicap peacetime output and employment. Probably there is danger that we may retain too long most of the price controls on manufactured articles. They restrict production at a time when we should be stimulating production, both because it creates employment and because it constitutes our only trustworthy defense against the dangers of inflation.

Conversion Unemployment

When industries were being converted for war work, the employment in them declined for five months, and then in seven more months it increased until it exceeded its pre-war level. It may be true that the timetable of the conversion to war work will help us in estimating the probable duration of reconversion to civilian production.

In five principal industries—hardware, structural steel, containers, radios, and automobiles—total employment decreased for the five "conversion" months after Pearl Harbor. In April, 1942, the total employment for the five was only 76 percent of the figure for November, 1941, the last full peacetime month. By far the greatest part of the shrinkage was taking place in the automobile industry, and it is interesting to recall that at that time it was called priorities unemployment because preparations for munitions making had priority over all other industrial activity. After April, employment in the conversion industries increased steadily, and by November, 1942, it was slightly greater than it had been in November, 1941.

Of course it may well be that the timing and the pattern of reconversion will not closely follow the course taken by conversion, and it must be remem-



Easy to Check Machine Speeds with Stewart-Warner Portable Hand Tachometer #757-W

THIS RUGGED, inexpensive, precision-built instrument is ideal for production engineers, maintenance superintendents, foremen, shop mechanics and service men. In a matter of seconds you can check the speed of machines, whether revolutions are clockwise or counter-clockwise.

Check-control of machines is vastly important in these days of heavy quotas, speeded-up schedules and the necessity for making equipment last longer. The Stewart-Warner Portable Hand Tachometer enables you to *be sure* you are getting maximum production from your machines. All these factors combine to make your plant most efficient.

This handy tachometer comes ready to use, with two tips. One, for shafts having a center hole. The other for measuring the speed of flat shafts, pulleys, etc. Easy to use, requires no attention, and checks speeds from 100 to 4000 R. P. M.

You need Stewart-Warner Portable Hand Tachometers in your plant. Write for complete details, today.

STEWART-WARNER
Industrial Tachometers

Stewart-Warner Corporation
1870 Diversey Parkway, Chicago 14, Ill.

Another Product of STEWART WARNER

OUT OUR WAY

ALL I CAN READ HERE IS IODOFORM-- IT DON'T SAY IF IT'S GOOD INTERNALLY!
OH, HERE'S DEL NOW! HE AIN'T CUT UP BAD, BUT HE'S SICK TO HIS STUMMICK! SLIPPED IN SOME GREASE AND TOOK A HARD FALL -- NOW ABOUT THIS IODOFORM...
NO-NO-NO! THAT'S FER EVERYTHING ELSE! THE OTHER BOTTLE THAT SEZ JAMAICA GINGER IS FER INTERNAL! DANG IT! WHY DIDN'T JOE PUT SPEEDI-DRI ON THAT OILY FLOOR?
J.R.WILLIAMS
AN OUNCE OF PREVENTIVE
T. M. REG. U. S. PAT. OFF. COPR. 1945 BY NEA SERVICE, INC.

PREVENTION is always the *best* medicine for any ailment . . . and for slick, sick floors and surfaces the best precaution is SPEEDI-DRI! SPEEDI-DRI, the oil-thirsty, granular absorbent, lays a carpet of safety under foot, while soaking up oil and grease. It does *its* work . . . while *you* work in safety!

SPEEDI-DRI saves valuable man-hours in floor-maintenance. No expensive machines required . . . no trained personnel. Anyone can use SPEEDI-DRI, quickly and easily. Just spread it around . . . and improve your *standing*.

Sweep it up with an ordinary, stiff broom . . . and you've got safe, clean floors. It's that simple. In addition, SPEEDI-DRI eliminates the danger of "flash-fires" on greasy, oil surfaces . . . for SPEEDI-DRI will not readily burn, even when oil-soaked!

Pin your card to this advertisement and mail today for full details and a generous sample of SPEEDI-DRI.

***SUPPLIERS: East*—Safety & Maintenance Co., Inc., New York 1, N. Y.**
***South, Midwest & West Coast*—Waverly Petroleum Products Co., Philadelphia 6, Pa.**

SPEEDI-DRI
OIL AND GREASE ABSORBENT

bered that most of the industries and individual plants that have been making munitions will have little reconversion to do, and many of them almost none. Nevertheless we have no data which will foretell the probable timing of reconversion, so it is worth while to study the timing of conversion in the industries which had much of it to do.

If it turns out that reconversion follows an employment pattern that is similar to that of conversion, we should expect employment to decline for five months in the industries that have much of it to do, and to reach its low point five months after this past July, or in December. The War Manpower Commission estimates that we may have 6,200,000 unemployed at that time. After December we should expect employment to increase in the reconversion industries for seven months, and to reach its normal full employment level in July, 1946.

In this connection it should be remembered that if we do have about 6,200,000 unemployed next winter a large proportion of them will not be factory workers. Moreover they will not be unemployed because there are not enough jobs potentially available for them, but rather because the huge process of readjustment and relocation cannot have been completed by then, and in some small degree because the intricate procedures of reconversion will not yet have been finished. There are so many and such huge accumulated shortages to be made good that there will be enough jobs for all who want them and can be competent in them, but not all can have them immediately on application.

•

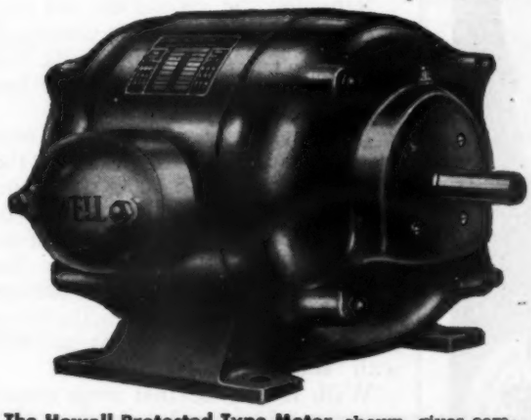
Providing for Employees' Welfare

JOHN E. HUBEL, Milwaukee

Corporations which have in mind making provision for employees who need financial and educational help will watch with interest the workings of an organization recently founded by the Le Roi Company, Milwaukee.

To "make gifts and contributions for the relief of needy persons, and to such needy, worthy, and deserving employees and former employees and for the relief of needy members of the immediate families," is the object of a nonstock subsidiary recently incorporated by this company. In the incorporation papers the aim of the organization, which is to be known as the Le Roi Foundation, is given as ex-

Mister, now's the time to figure on *Horsepower by Howell*



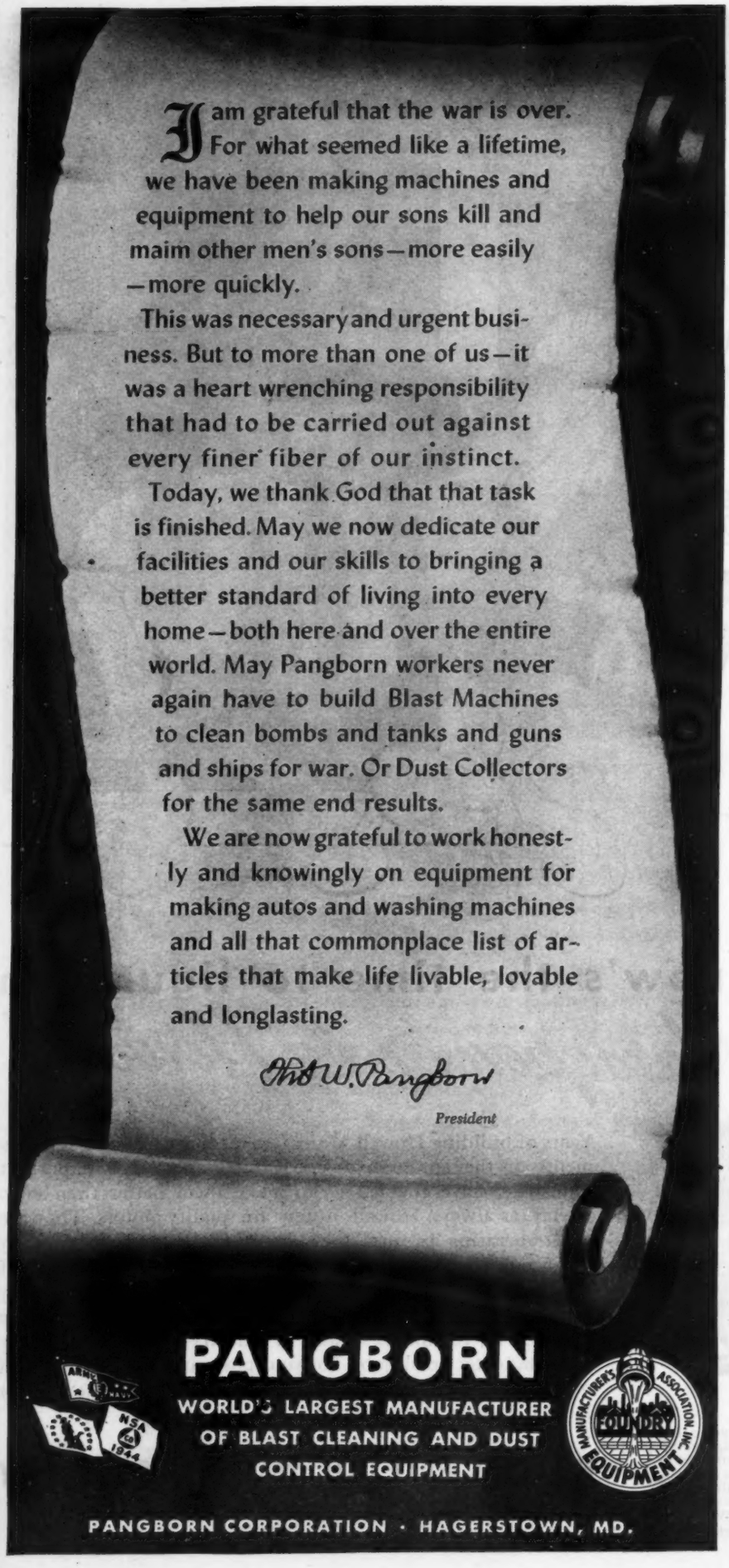
The Howell Protected Type Motor, shown, gives complete protection against dripping liquids, metal chips and other falling particles. Completely streamlined—utilizing non-breakable steel frame—malleable or steel base—cast iron end plates and cast iron, weatherproof terminal box are standard construction features. Special horizontal and vertical mountings are available. *Available in sizes 5 H.P. and smaller. Other sizes and types available up to 150 H.P.*

Years of building Howell Motors, to meet the exacting requirements of the automotive, dairy, food and other important industries, have enabled us to make them better than ever. Today, as always, Howell Motors are quality-motors. They are quiet-operating because they are statically and dynamically balanced. They are better performing because they are built of the finest materials—copper or bronze rotors—and completely insulated. They are trouble-free on the job because they are designed for the toughest tasks in industry—consequently, they perform better on all jobs. For your postwar need in specialized or standard motors, from ¼ to 150 h.p., phone the nearest Howell Representative today.

HOWELL ELECTRIC MOTORS COMPANY

HOWELL, MICHIGAN

Manufacturers of Quality Motors Since 1915


I am grateful that the war is over. For what seemed like a lifetime, we have been making machines and equipment to help our sons kill and maim other men's sons—more easily—more quickly.
This was necessary and urgent business. But to more than one of us—it was a heart wrenching responsibility that had to be carried out against every finer fiber of our instinct.
Today, we thank God that that task is finished. May we now dedicate our facilities and our skills to bringing a better standard of living into every home—both here and over the entire world. May Pangborn workers never again have to build Blast Machines to clean bombs and tanks and guns and ships for war. Or Dust Collectors for the same end results.
We are now grateful to work honestly and knowingly on equipment for making autos and washing machines and all that commonplace list of articles that make life livable, lovable and longlasting.
Thos. W. Pangborn
President
PANGBORN
WORLD'S LARGEST MANUFACTURER OF BLAST CLEANING AND DUST CONTROL EQUIPMENT
FOUNDRY EQUIPMENT
PANGBORN CORPORATION · HAGERSTOWN, MD.

clusively charitable, scientific, educational, and literary.

Scholarships will be provided for employees of the company, and funds will be made available for returned veterans' rehabilitation. It is especially provided in the bylaws that no discrimination shall be made against anyone on account of race, creed, or political affiliation.

•

Wartime Pay for Less Work

(The following is reprinted from the "New York World Telegram")

We don't blame auto workers, steel workers, rubber workers, or any other workers for wanting to keep on taking home each week as much pay as they took home during the war. That is a normal, understandable desire.

Demanding as much take-home pay, or more, for doing less work per week is another matter.

In wartime the industrial work week lengthened, from 40 hours or less in most cases to 46 hours, 48 hours, or more in many cases. For hours worked beyond 40 a week, time-and-a-half hourly wages were paid. As a result, weekly earnings increased more rapidly than hourly wage rates. And, according to the Labor Department, average hourly wage rates in all manufacturing industries increased about 36 percent between Pearl Harbor and V-J Day.

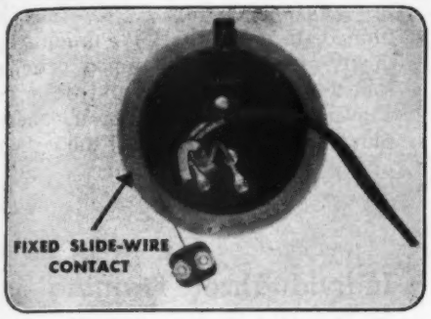
The big CIO unions or auto, steel, rubber, and other workers are now demanding that hourly wage rates be further raised about 30 percent. The idea is that, for 40 peacetime hours, the workers should get approximately the same weekly pay they got for 48 wartime hours.

Naturally, the unions do not emphasize the point that, for continued take-home pay at wartime levels, the workers would do a great deal less work.

They emphasize, instead, their contention that they are fighting for the country's welfare—fighting to maintain purchasing power and prevent an economic crash. And they say that industries can pay the increases demanded without raising prices, because the efficiency of industrial methods has gained and the corporations are rich with "swollen wartime profits."

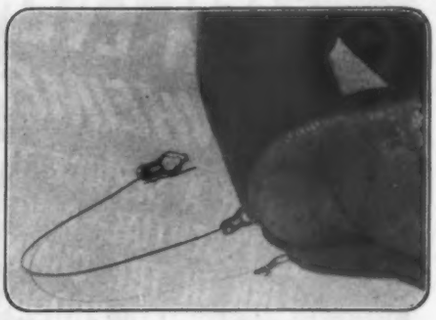
Well, it may be that some corporations could raise hourly wages 30 percent at this time without raising prices and so cutting everybody's purchasing power. But we are sure that other corporations—the great majority, probably—could not. The alleged war-

6 THINGS TO LOOK FOR in choosing Controlling Pyrometers

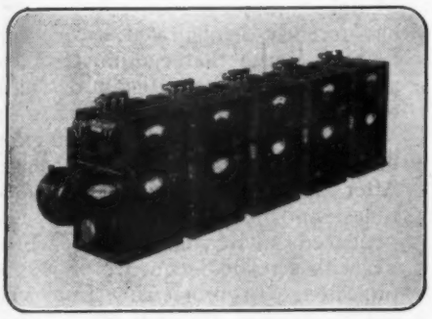


1. Fixed Slide-Wire Contact. Setting the dial places the slide wire contact at the desired value, where it remains, so that the galvanometer deflection represents temperature deviation from the control point. Detection for control purposes can be applied directly to the galvanometer.

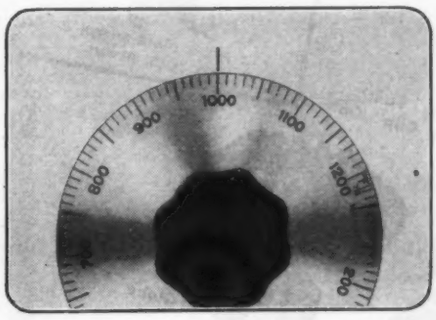
2. Knife-edge Selectivity. The slightest galvanometer deflection is instantly "sensed" and translated into corrective action by Foxboro's "knife-edge" detecting mechanism. Selectivity is positively determined by engagement or non-engagement of the depressor and the pointer.



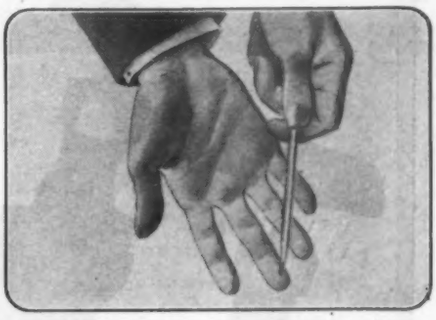
3 Non-Breaking Galvanometer Suspensions. Foxboro galvanometer suspensions do not break. The patented mounting is scientifically designed to distribute tension correctly, eliminating shear strain, and the acid proof gold alloy strips are longer, heavier, and stronger.



4. Group Drive. Unlike any other pyrometers, Foxboro Potentiometer Controllers are designed for group driving, so that a single motor unit can operate up to 5 instruments. Initial cost, power, spare parts inventory and maintenance are saved.



5. Easy, Accurate Setting. A super-size scale, 11 inches long, enables unusually accurate settings of the Foxboro Potentiometer Controller. Every graduation represents a temperature value of less than one per cent of scale range.



6. Only Three Moving Parts. Some models have only three moving parts and none have more than half a dozen, all designed to operate at slow speeds. Foxboro design engineering produces close control with simple mechanism.

• • •

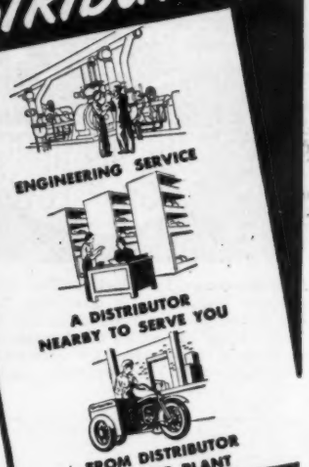
You're taking the shortest cut to higher accuracy and sensitivity in pyrometers . . . plus utmost uniformity, dependability and maintenance-freedom in your heat-treating installations . . . when you select instruments with all six of the big advantages described above. Foxboro Potentiometer Controllers alone give you *all* these important features.

Bulletin 202-6 will give you complete details about these better-engineered pyrometers. Write **The Foxboro Company, 24 Neponset Avenue, Foxboro, Mass., U. S. A.** Also Montreal, Canada. Branches in principal cities.

FOXBORO REG. U. S. PAT. OFF. **POTENTIOMETER INSTRUMENTS**

Relied upon
BY VALVE MAINTENANCE MEN EVERYWHERE . . .
LUNKENHEIMER DISTRIBUTORS

RENDER A SERVICE THAT IS ESSENTIAL—A VITAL LINK IN THE CHAIN OF INDUSTRIAL PRODUCTION



Throughout the war, Lunkenheimer Distributors did a fine job in helping to maintain industrial valve installations at top efficiency.

Located in leading industrial centers, our Distributors have provided quick, readily accessible, and complete valve service throughout the nation.

In addition to supplying high quality, long life Lunkenheimer Valves, they have assisted maintenance men in the solution of both operating and maintenance problems.

This service isn't new...Lunkenheimer Distributors have been rendering it for many years in the past, and will continue doing so in the future. For this Distributor set-up is a basic, permanent part of the Lunkenheimer way—the *better service* way.

You can always depend on your nearby Lunkenheimer Distributor for expert, experienced aid in the solution of valve maintenance and operating problems. Call on him!

The Lunkenheimer Co., Cincinnati 14, Ohio, U. S. A. (Offices: New York 13, Chicago 6, Boston 10, Philadelphia 7. Export Department: 318-322 Hudson St., New York 13, N. Y.)

LUNKENHEIMER VALVES

BRONZE, IRON, STEEL AND CORROSION RESISTANT ALLOY VALVES, 125 TO 2500 LB. S. P.; BOILER MOUNTINGS, LUBRICATING DEVICES, AIRCRAFT FITTINGS

time gains in industrial efficiency have not yet been applied to peacetime production. The "swollen wartime profits" of many companies exist only on the trick charts devised by union statisticians.

We believe that many upward wage adjustments are possible and desirable now, and that more can and should be made later. But we fear that, as immediate goals, the CIO unions' industry-wide demands are so extreme that a fight for them would delay reconversion, prolong post-war unemployment, and react against the welfare of the workers and all others.

•

Individualized Training Helps Place Engineers

Based on the theory that an engineer finds the right job by working at several, and thereby becomes a more efficient employee, Allis-Chalmers Manufacturing Company, Milwaukee, has recently inaugurated a two-year training course that coordinates shop and office work in a program designed to fit individual aims and abilities.

The graduate engineer is given great flexibility in laying out his course. After discussion of experience, aptitudes, and preferences with an experienced adviser, a training schedule with a related sequence of jobs is projected. In progressing from one job to another, the individual's ideas may change, in which case his course is modified to coincide with the new objectives.

•

The Way to Future Prosperity

(Reprinted, in part, from "The Bank Letter," published by The National City Bank of New York.)

The end of the war has come suddenly, and in circumstances of unparalleled drama. . . . Thus comes to an end six years of the most widespread, stupendous, and destructive warfare in all history. In this country, as among our Allies, the uppermost feelings are of joy and thanksgiving that the bloodshed and waste are over and the long anxiety ended. . . . Mingled with these feelings are others of uncertainty and questioning as to the post-war situation. . . . In the modern world the industrial and financial organization is almost incomprehensibly complex. The division of labor and variety of production and exchange of goods and services have

JONES DRIVES FOR INDUSTRY

★ For many years the W. A. Jones Foundry & Machine Company has been called upon as a consultant, to help solve a great variety of difficult drives involving the use of speed reducers, gears and other transmission machinery. In many cases these installations have called for the development of special equipment, designed and built to suit the specific requirements of the project.

As a result of these years of experience, involving numerous special problems in the mechanical transmission of power, the Jones organization has collected a vast amount of technical data relating to work in various fields.

Specific bulletins and catalogs are available on the products listed below and a general 20 page bulletin "Jones Drives for Industry" presents a broad picture of Jones products, engineering services and manufacturing facilities.

W. A. JONES FOUNDRY & MACHINE CO.
4433 Roosevelt Road, Chicago 24, Illinois

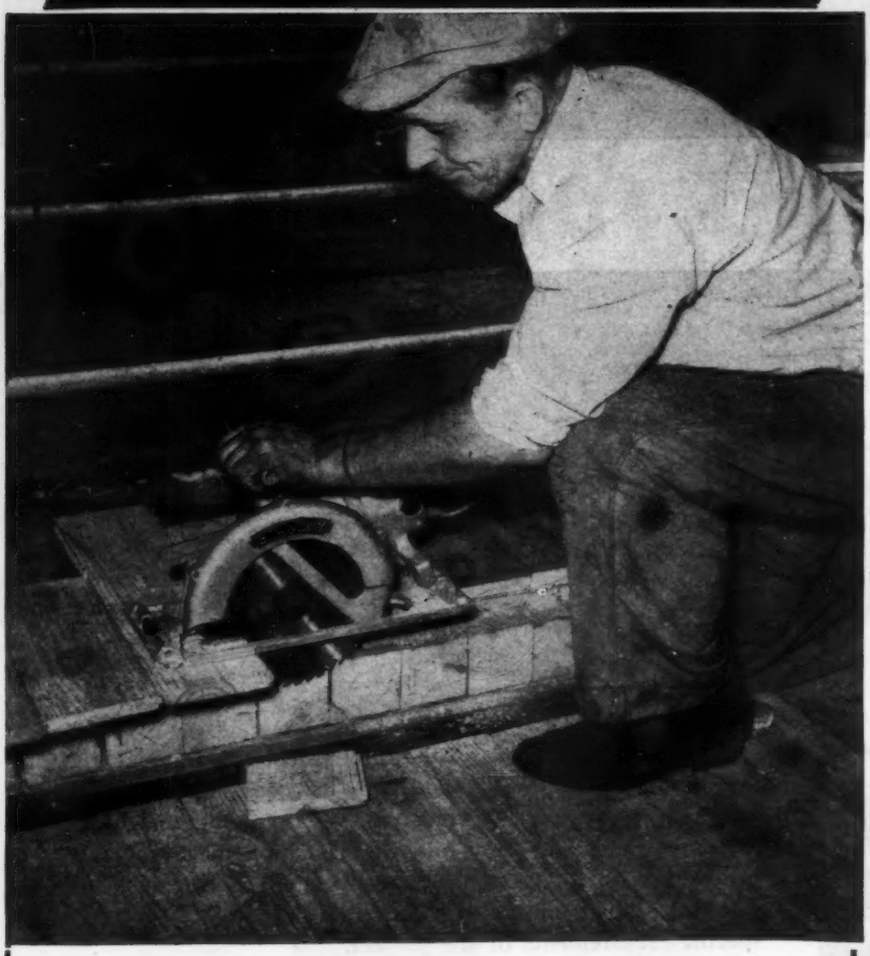
JUST ASK FOR BULLETIN NO. 80 ➡

• These illustrations show application of Jones drives to solve a wide range of industrial power transmission problems.

Jones

HERRINGBONE—WORM—SPUR—GEAR SPEED REDUCERS • CUT AND MOLDED TOOTH GEARS • PULLEYS
ANTI-FRICTION PILLOW BLOCKS • V-BELT SHEAVES • FRICTION CLUTCHES • TRANSMISSION APPLIANCES

A hurry-up TOOL



for maintenance jobs

The Stanley W9 Safety Saw sinks its teeth into such maintenance jobs as floor and stair repairing and platform rebuilding and betters your best expectations. Handles like a hand saw but much faster. With its 3¼" cutting capacity and tilting base for bevel cuts up to 45° in 2¼" material, this Stanley Saw may be the very manpower your maintenance crew is missing.

May be equipped with special blades for a wide variety of jobs and materials. Stationary and swinging guards keep cutting edge covered at all times. Just one adjustment for different depths of cut. Write for folder. Stanley Electric Tools, Division of The Stanley Works, New Britain, Connecticut.

STANLEY

STANLEY SAFETY SAWS

become constantly greater, and all the parts of this vast system are mutually dependent to an extent unknown in earlier days. The system has yielded immeasurable benefits to all the people engaged, by raising standards of living. It depends for its functioning, however, upon peace, order, and balanced trade, and the effect of total war upon it is one of violent disruption.

This system was disrupted in 1914–18, and now again. The problem is to avoid a repetition of the chain of effects—the inflation and deflation, boom and depression, monetary, fiscal, and social disturbances—which followed after 1918 and led in unbroken sequence to the new war. . . .

Capacity to Produce

In all countries the test of ability to recover from the war and regain a state of prosperity is in the capacity to produce a flow of goods and supply the wants of the population. There is no other measure of the general welfare than the production, distribution, and consumption of goods and services. If production is insufficient, distributions of money, whether in the form of international loans or internal "relief," will be unavailing in recovering the standard of living. The problem is obscured by thinking of it in terms of money.

In the United States it cannot be doubted that the material elements necessary for a state of prosperity, including natural resources, labor, and industrial capacity, are present in abundance. The country has suffered no destruction or loss of its means of production during the war, but, on the contrary, probably has had an increase, assuming that the addition of war plants and machinery which can be adapted for peacetime use has more than offset depreciation of old plants and machinery. In shipping, the net gain is enormous. Immense technological progress has added to our productive power.

Nor is there much doubt that a period of great activity awaits the country as soon as readjustments to a peacetime basis are made. Inherently the business outlook is strong. Stocks of many kinds of goods are low, much household, transportation, and industrial equipment is worn out or obsolete, and needs are pressing. Construction and repair work are behind. The country could have done a huge cash export trade in the past year if goods and shipping had been available, and buyers abroad want to make up their arrearages as well as buyers at home. Unquestionably, heavy demands are

"WHEN I SAY UNIT HEATERS... I MEAN Modines ...none of this 'or equal' stuff goes with me!"

Courtesy of Curtis Lighting, Inc.

●Hard-boiled? No—just hard-headed. And *quality-wise* as foresighted buyers of unit heaters always are. Because, it's *performance* they're after!

Unit heater performance has to be *built-in.* As Modine builds it in...

With highest quality materials. With first rate workmanship. With the long-experienced engineering *know how* that comes from 29 years of specialization in building heat transfer equipment. With the outstanding unit heater advancements, exclusively Modine!

Quality-built Modine Unit Heaters are still setting the standard of high-efficiency performance today *after the war*... just as Modines did before the war, and during the war...in thousands of installations *in every type of industry.*

In these highly competitive postwar days your plant heating must be a production asset, not a liability. If you buy unit heaters built-to-meet-a-lower-price, excessive operation and upkeep costs invariably result.

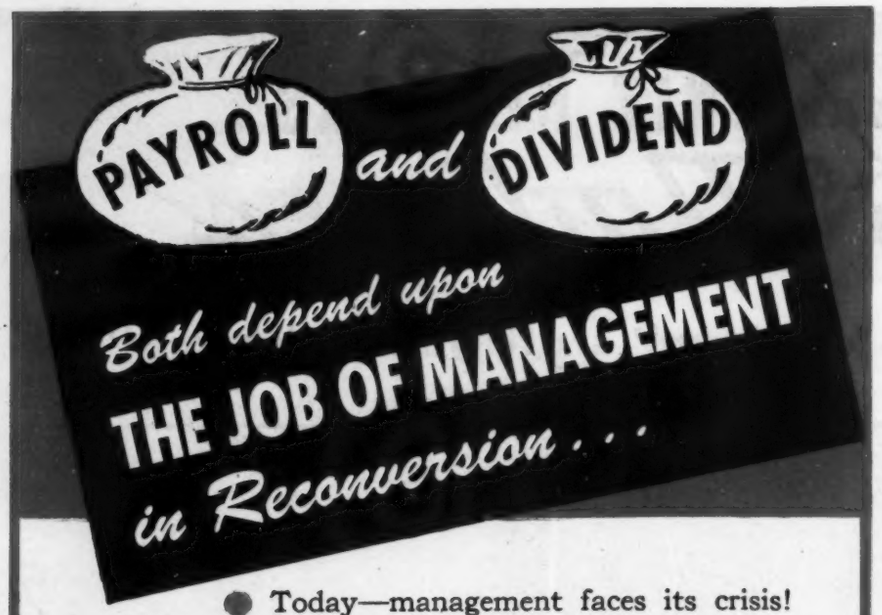
Don't compromise on quality. *Specify Modine Unit Heaters.* There isn't any "or equal."

Look in your phone book for Modine representative's name —"Where to Buy It" Section

WRITE FOR BULLETINS 145 and 144-A

MODINE MANUFACTURING COMPANY, 1730 RACINE STREET, RACINE, WISCONSIN

Modine Unit Heaters



● Today—management faces its crisis! Upon the speed and the wisdom with which its plans for reconversion are set into motion depend both payroll and dividend. Only the efficient can survive!

Complete mechanization, enabling the most productive use of manpower, is of primary importance. Equipment that will do it better, faster, and cheaper is the best insurance for the future.

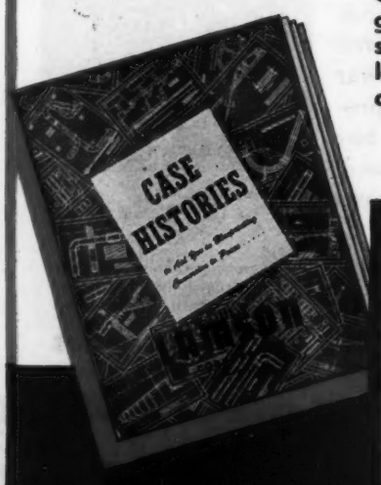
Lamson Conveyors and Lamson Pneumatic Tubes—engineered installations of these two cost-cutters helped win many an "E" award. The same plants will have a head-start in the race for the consumer dollar—the race that is already starting!

To assist you in your planning, we'd like to send the

FREE BOOK "CASE HISTORIES

to Aid You in Blueprinting Conversion to Peace . . ."
Come inside some of America's greatest industries with us—and see how they will handle the problems of increased output at lower cost.

Ask for your copy TODAY!



LAMSON CORPORATION
150 Lamson St., Syracuse 1, N. Y.
Please send my copy of your reconversion booklet. I'm willing to learn what your planning assistance has done for others.

Name..... Position.....
Company.....
Address.....
City and Zone..... State.....

waiting, ready to come forward when the country is able to supply them at a price level satisfactory to buyers.

Doubts therefore relate to the transition or reconversion period. Materials, plants, and workers have been mobilized to give war production priority, and now a reorganization is required. Some industries and communities must shrink, others expand. Men and women from the armed forces and the war factories must come back into occupations where everything they produce must be taken off the market by public demand. The productive organization must be reshaped, from a situation where many plants have worked largely for one customer, back to filling the wants of a multitude of customers. The process must work itself out and there are inevitable difficulties.

Reconversion Problems

General opinion probably attaches most importance to the physical problems of reconversion, such as the clearing of plants of war inventories and their re-equipment, redirection of the flow of materials and parts, and shifting and retraining of workers and contentions that the country faces a "great emergency" are based largely on these difficulties. Without belittling them, it is likely to be seen in due course that these are the minor and temporary problems. Many industries do not have to reconvert at all, and in those that do, preparations are well advanced. . . .

Contract termination procedures are excellent, and settlement or part payments are as prompt as could be expected, considering the magnitude of the task. . . .

The sudden ending of the war and the abrupt termination of war work will facilitate the reorganization of production. It will make ample supplies of materials, machines, and labor speedily available, and thus will relieve "bottleneck" difficulties. . . .

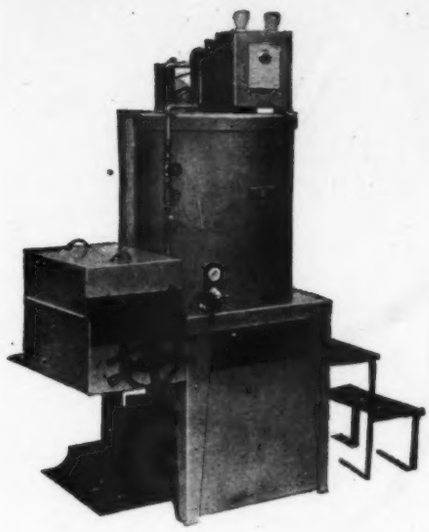
Finally, and perhaps most important of all, the policies of the federal government and the measures taken by the federal agencies imply in general that reliance for rapid reconversion is being placed upon the ingenuity and resourcefulness of businessmen themselves, and not upon schemes for government direction and control. Nothing was more to be feared, either for the transition period or the longer future, than regulations subjecting every major decision of business to the approval of Washington, with the certain result of confusion, delay, mistakes, and injustices. But the moves since the surrender have shown that the policy is to free business of its

HOW MANY GALLONS OF 50¢ OIL CAN YOU BUY FOR *ONE* DOLLAR?

TWO?..... wrong

THREE...OR FOUR OR MORE...RIGHT!

THIS DOES IT



THE YM OIL REFINER

This is one of the new models of the YM Oil Refiner. Units are available in many sizes.

The YM unit is *not* a mere filter— it's a *real oil refiner!*

The YM Refiner removes *all* of these contaminants: fuel dilution; water, even when emulsified; gums, asphaltic materials, "gunk" that's dissolved in the oil itself. It brings acidity down to new oil values.

And it does all these things economically...without any pre-settling or pre-treatment!

With the YM Refiner, you use the same oil over and over again...no need to discard a single quart. And your machinery is safeguarded from the damage that contaminated oil can cause.

Another point: oil refined in the YM unit is outstanding in anti-varnish properties. The YM removes sludge accumulations—prevents their formation. Oil refined in a YM unit is *aged... more stable.*

You can use the YM unit to restore used lubricating oils—cutting and hydraulic oils—transformer oils—Diesel and gasoline engine oils. Users near you can tell you how effectively the YM Oil Refiner has served them. And we'll be glad to show you how much *you* can save by its use!

THE YOUNGSTOWN MILLER COMPANY

A Subsidiary of

Walter Kidde & Company, Inc.
1014 Kidde Avenue, Belleville 9, N. J.

Save OIL...and you save MACHINERY

with the **YM OIL REFINER**

MAIL THE COUPON FOR FURTHER DETAILS

The Youngstown Miller Company
1014 Kidde Avenue
Belleville 9, New Jersey

Gentlemen:
Please send me further information about the YM Oil Refiner.

Name.....
Position.....
Company.....
Street Address.....
City and State.....

UTICA
TOOLS
for More Tool Mileage

Pliers for Every Need

UTICA's experience and care in manufacturing make UTICA Pliers and Adjustable Wrenches the choice of good mechanics — for *more tool mileage*. Sold only through recognized distributors.

BUY VICTORY BONDS!

U TI CA
UTICA
DROP FORGE & TOOL
CORPORATION
UTICA, N.Y.

terferences with production—in some respects at once and in others gradually—and put it on its own.

The first step was to cancel war contracts promptly, in order to cut the cost and stop the waste of war, reduce the inflation danger, free materials, machines, and labor for peacetime goods, and clear the decks for a fresh start. . . .

The second step was to remove most of the wartime limitations on production and on the use of materials. . . .

Opposing Views

In general, businessmen share an optimistic view of the readjustment period and confidence is reflected in well-maintained trade and rising stock markets. But there is a dissenting view, expressed by labor leaders more than others, which foresees a "great emergency," and this opinion contributes to confusion and uncertainty. It holds that even though the energies of private enterprise are enlisted and given scope, private enterprise alone will not be enough, and that positive government action to provide or stimulate employment is called for. Sidney Hillman, national chairman of the CIO Political Action Committee, was quoted in the press as estimating that "10,000,000 workers will be out of work within the next six to eight weeks," and as demanding more government relief and support. . .

Hillman's figure of 10,000,000 far exceeds other estimates of probable unemployment in the present reconversion period, and in our judgment statistical support for it, and for other high estimates, is lacking. Of course the unemployment actually is unpredictable because it is not foreordained. It depends upon many circumstances, among others the willingness of labor to work for wages which employers, who must sell their goods and services to the public, can pay. There is evidence from all centers of shortages of workers in the trades and services, but thus far many of the released war workers refuse such work, clinging to the hope that they can find jobs at wages closer to what they made in the war plants. The economic organization can give them no guarantee of such jobs.

The danger in forming an exaggerated view of the probable unemployment is that people may be driven through fear to endorse programs for making work, or for greatly extending unemployment compensation and easing the qualifications for it. Of course worthy public works projects such as road improvement, long needed and deferred during the war, and for which

LOOK INSIDE THE *Machine* FOR NEW ECONOMIES IN ANY INDUSTRY

Putting the bite on "OVERHEAD"!

This giant overhead coal cutter shows how you, too, can cut overhead. A veritable power plant on wheels, it represents many of the conditions *inside the machines* in your plant.

Those cutter-head gears (top) are subjected to heavy shock loads. A special Socony-Vacuum oil cushions the shocks. The boom gears (center) operate under high-unit pressures. A select lubricant meets this condition. Hydraulic power controls the mechanism. A new oil transmits this power.

All this is just one sample of how Socony-Vacuum research answers the needs of every part of every machine. And back of these new developments is our Complete Lubrication Service for your plant. Get this service now.

SOCONY-VACUUM OIL CO., INC. and Affiliates: Magnolia Petroleum Company, General Petroleum Corp. of Calif.

Call in

SOCONY- VACUUM

GARGOYLE Lubricants

for Correct Lubrication

Socony-Vacuum's 5 STEPS to Lower Production Costs for You!

1. Lubrication Study of Your Entire Plant
2. -ubrication Schedules and Controls
3. Lubricant Storage and Handling System
4. Skilled Engineering Counsel
5. Progress Reports of Benefits Secured

A $1900.00 MACHINE
AND A $1.90 SAW BLADE

BUT

the SAW does
the cutting . . .
not the machine!

And MILFORD PROFILE SAW does it best! You can do contour or profile sawing on any vertical machine equipped with proper guides and speeds. But there is a world of difference in the saw you can use.

MILFORD PROFILE SAW is the product of a group of specialists who make nothing but metal cutting saw blades. It is made with painstaking care and the most modern equipment to do the best all-around cutting job that can be done . . . on any and all machines.

That's why you should specify MILFORD PROFILE SAW . . . and insist on getting it.

Now packed in an improved stronger box, from which the saw can be stripped free . . . no binding . . . no buckling.

Complete stock is carried by all MILFORD distributors in every industrial center from coast to coast . . . as near as your telephone.

THE HENRY G. THOMPSON & SON COMPANY
SAW SPECIALISTS EXCLUSIVELY FOR OVER 65 YEARS
NEW HAVEN 5, CONNECTICUT
Makers of Rezistor and Duplex Hack Saw Blades

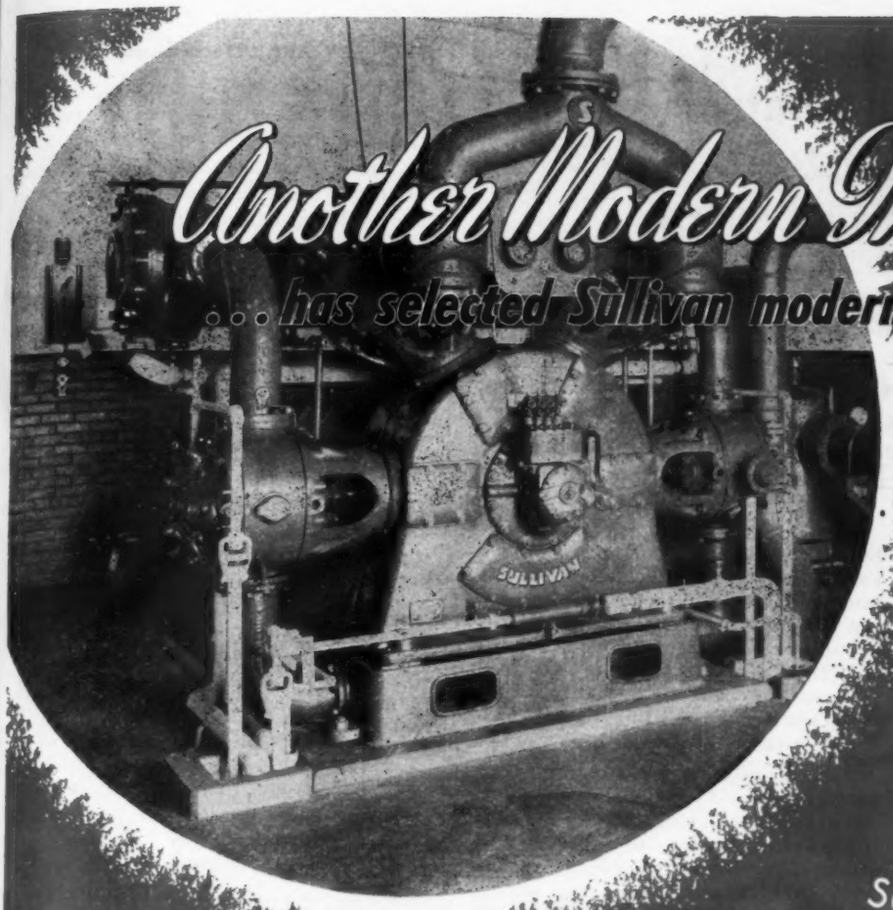
funds have been set aside and plans prepared, should now stand on an equal footing with private work, and if they can be carried out during the transition period it is particularly desirable to do so. Projects designed primarily to give employment under the plea of emergency, however, fall in a different category. They are wasteful, costly, and inflationary. The indications are that before most such projects could be started the "depression" will be curing itself, and "made work" then would compete with the industries for men and materials and add to the inflationary forces.

Unemployment Reserves

The unemployment compensation funds of the states have reserves amounting to over $7,000,000,000, created to help workers through temporary unemployment. These are the funds which should bear the impact of reconversion upon displaced workers. Also it is a sound rule that unemployment compensation rates should be less than the wages obtainable in self-supporting work, and the regulations requiring those on the rolls to accept available jobs should be strict. Otherwise how can employment be restored in the trades and services, the laundries and cleaning establishments, and all the other essential businesses which have been, and still are, short-handed?

Fundamental questions of adjustment to peacetime conditions are involved in the proposals for making work, for increasing unemployment compensation through federal appropriations, for 20 to 30 percent advances in wage rates, higher statutory minimum wages, and similar measures. . . The major and longer-range problem is to work out the necessary adjustments in trading relations, or in other words wages, costs, and prices, so that trade can go forward, production can be carried on, and the product distributed and the markets cleared.

Some may think there is little cause for concern over cost and price relations, in view of the strength of the waiting demand and the unprecedented amounts of money which people are holding. They will argue that business can pay increased wages, and that sustained take-home pay is necessary to absorb production. But such comments overlook the main point, which is the inflation danger, and the influence of wage rates on costs. It is perfectly possible to have for a time a large volume of trade at inflated costs and prices, supported by the huge money supply and exaggerated, if experience is a guide, by speculation, inventory accumulation, and extrava-



Another Modern Industry

. . . has selected Sullivan modern air power . . . .

SPERRY

Thompson Products, Inc.

SOLAR AIRCRAFT COMPANY

BENDIX AVIATION

STUDEBAKER

BELL Aircraft

Airacobras for victory—

LIKE so many other industries that have progressed by the bold and continued adoption of better and better methods, materials and machines, aviation has achieved the impossible in production of military planes. The contribution of compressed air from Sullivan *modern* air compressors cannot be emphasized too highly.

This SULLIVAN WN-114, four cylinder semi-radial air compressor recently installed in the newest plant of the largest aviation company, drives hoists, chucks, and boring mills, cleaning, sand-blasting and other air equipment and is used at reduced pressures in the all-important air-flow combustion control systems of the power plant itself. Many other aviation companies have similar installations working continuously.

Sullivan Series 100 Air Compressors are two-stage, double-acting, long-lived, heavy duty continuous service compressors—much more compact than old style compressors of the same capacity and yet have operating economies exceeding older and bulkier units. They are available in two and four cylinder models and in single or twin units with capacities from 378 C.F.M. to 3656 C.F.M.

Sullivan Machinery Company, Michigan City, Ind. In Canada: Canadian Sullivan Machinery Co., Ltd., Dundas, Ontario.

SULLIVAN

AIR COMPRESSORS FROM 1/4 TO 3,000 H.P.

PRODUCTS

Stationary and portable air compressors from ¼ to 3,000 H.P., pneumatic casting grips, foundation breakers, portable hoists, rock drills.

OFFICES { Seattle, Boston, New York, Chicago, Portland, Pittsburgh, St. Louis, Detroit, San Francisco, Birmingham, Knoxville, Huntington, Los Angeles, Duluth, El Paso, Butte, Salt Lake City, Scranton, Denver, Dallas

Air Pollution Control as an aid to Product Quality Control

The activated carbon in DOREX Air Recovery Equipment effectively *removes* air-borne acids, gaseous oxides and befouling odors. Thus it prevents the contamination of food and food ingredients, chemicals, drugs, etc., and protects a wide range of materials from the action of air-entrained chemicals.

Works like a gas mask

Nothing is added to the air. Vaporous and gaseous contaminants are *removed*, not disguised.

Activated carbon is the most powerful adsorption material known. It has been used for many years in industry for the recovery of chemicals in vaporous and gaseous form.

DOREX Air Recovery Equipment employing activated carbon can be installed in a ventilating system to remove contaminants either at outdoor air intake or from air in recirculation. In addition, portable units are available to take care of intermittent or localized concentrations of contaminants.

For example, DOREX is helping maintain control of product quality in processes like these:

A *film manufacturing plant* had been experiencing erratic results in film sensitivities, the cause of which was finally traced to impurities in the outdoor air supply. Analysis in a DOREX pilot plant set up to remove the impurity revealed that it was phosphorus originating from a smelting process several miles distant. Complete protection of the plant with DOREX reduced costly rejects and relieved the concern of the management that a run of sub-standard film might escape detection.

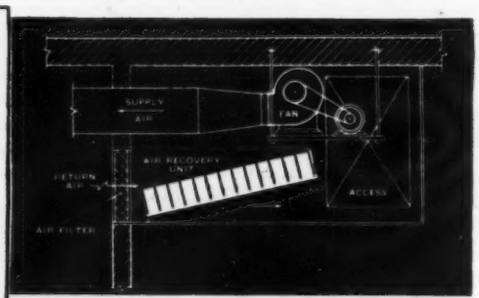
A *food processing plant* found that self-generated odorous impurities were contaminating food and food ingredients during processing and storage. Removal of the contaminants with DOREX eliminated the necessity of bringing in and conditioning large quantities of unconditioned outdoor air to dilute the impurities.

Engineering Help Available

The W. B. Connor Engineering Corporation maintains a research laboratory, a staff of trained specialists, and district representatives in leading cities whose services are at the disposal of Consulting Engineers, Architects, Air Conditioning Equipment Distributors and Plant Engineers. Our staff can help you apply the sound advantages of Air Purification to any manufacturing operation, where contaminated air threatens product quality or production efficiency.

Another important advantage of DOREX Equipment.

Dorex activated carbon effectively removes the contaminants that make air stuffy and stale and restores it to original freshness. With DOREX installed in your heating or air conditioning system you can cut down on outdoor air supply and recirculate greater amounts of air that you have already heated, cooled or humidified. Thus you reduce the load on heating, refrigerating and humidifying equipment, lower operating cost or expand the capacity of the system.



Typical application of DOREX equipment for decontaminating recirculated air. A variety of DOREX equipment types and sizes permits easy installation in most existing systems.

W. B. CONNOR ENGINEERING CORP.

AIR RECOVERY • AIR PURIFICATION • AIR DIFFUSION

112 East 32nd Street — New York 16, N. Y.

WB CONNOR ENGINEERING CORP.

of many kinds. This, however, is precisely what all sensible persons fear. It is an inflationary boom. . .

The rise in unit costs of civilian products during the war has been general and substantial, due primarily to wage increases but in many cases also to lower output per worker. Doubtless man-hour output will be increased as the situation changes, and inefficient workers are weeded out. Greater efficiency and elimination of overtime and upgrading will tend to reduce costs. On the other hand, the industries must figure in sales and distribution costs again; in most cases they have lower volume; and they are deeply concerned with the danger of labor disturbances, restrictive union practices, and similar cost-increasing factors. It is generally agreed that the present cost of living and the inevitable decline in take-home pay forbid general cuts in wage rates, but costs of industrial production should come down nevertheless, for many people are due to suffer a loss of money income and the situation will be out of balance unless the goods they want are priced at what they can pay. . .

The way to reduce costs without reducing wage rates is to improve productivity. Every obstacle to an increase in productivity is a menace to prosperity.

Depression Will Be Short

Confusion as to whether the country should fear inflation or deflation most is evident in many quarters. . . The evidence is convincing that the reconversion depression will be relatively short, and that accumulated resources and arrangements for relief and support already made can carry the country through it without widespread distress or crisis. If this is correct, then the sound public policy is to avoid more intervention than is already planned, to trust in the recuperative power of the industrial organization, and give it time to turn around and get on its feet. Moves in the contrary direction, involving either large government expenditures or measures that would increase industrial costs, would add to the inflation danger. They would be self-defeating, so far as encouraging a sound recovery is concerned, by reason of the interference with normal adjustments.

The responsibility for working out sound trading relations and a sound price structure belongs to everyone. It cannot be done successfully by arbitrary authority. The government has the greatest responsibility, since it is maintaining controls over prices and over wages wherever prices would be affected by increases. It must strike a

WHEN YOU NEED Lap-Joint Stub Ends

Whenever a flanged joint is required, the lap-joint stub end has a great advantage over flanges welded to the pipe. The swivel flange makes it unnecessary to accurately line up the bolt holes before welding; "setting up" is simple and quick because no special clamps or jigs are required to hold the face of the flange absolutely perpendicular to the axis of the pipe. The result is a real saving in time and cost of welding. Field crews report a saving of 25% in erection time for making up a joint using Midwest Lap-Joint Stub Ends in comparison with flanges rigidly fixed to the pipe.

Specify MIDWEST FOR THESE REASONS

FORGED LAP—by special Midwest process that simultaneously upsets pipe and forms lap. Tests prove superiority of process.

LARGE RADIUS FILLET—More metal, hence greater strength, in the critical area of lap where maximum total bending and shearing stresses occur.

HEAVY LAP—After machining front and back, lap is always at least equal to pipe wall thickness.

STRESS RELIEVED—Metal in lap is worked at forging heat, then normalized to assure uniform, close grained structure. Photo-micrographs frequently show it to be superior to original pipe metal.

SQUARE CORNER—(instead of a round corner) adds to lap strength and eliminates pockets for accumulation of condensate and sediment which promote corrosion.

MACHINE BEVELED—welding end is accurately machined for easy welding.

PHONOGRAPHIC FINISH—of lap face to hold gasket more securely.

UNIFORM FLANGE BEARING—Back face of lap carefully machined to assure uniform flange bearing necessary to satisfactory joint.

TIME SAVED—In welding and erection because bolt holes need not be carefully lined up before welding.

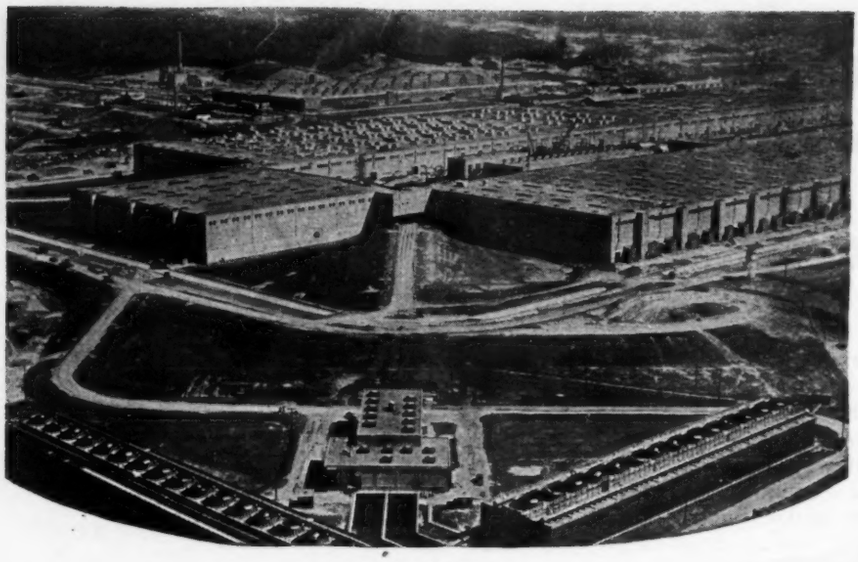
MIDWEST

PIPING & SUPPLY COMPANY, INC.

Main Office: 1450 South Second St., St. Louis 4, Mo.

Sales Offices: New York 7—(Eastern Division) 30 Church St., Chicago 3—645 Marquette Bldg. • Los Angeles 33—520 Anderson St. • Houston 2—229 Shell Bldg. • Tulsa 3—533 Mayo Bldg. • Atlanta 3—Red Rock Bldg. • South Boston 27—426 First St. • Distributors in Many Cities

MIDWEST WELDING FITTINGS IMPROVE PIPING DESIGN AND REDUCE COSTS



Signal Corps Photo

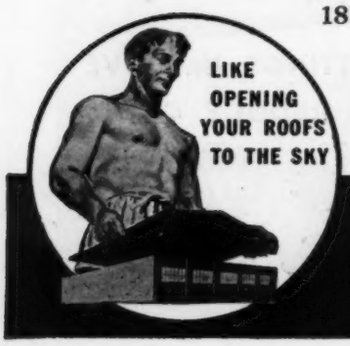
Swartwout Roof Ventilators in War Plant Installations—

Helpful guide to your peace-time factory ventilation

MANY of the most prominent war plants are equipped with Swartwout-Dexter Heat Valve, Swartwout AIRMOVER, Swartwout Rotary and Stationary Ventilators — assuring clarified atmosphere by the elimination of smoke, fumes and heat from production areas. This is an important factor in promoting efficient operation.

Prominent among these plants are the Oak Ridge atomic bomb plant (photo), Kaiser Corporation steel mill at Fontana, Calif., 155 mm shell plants at Denver and Fontana, Chase Brass & Copper Company shell plant at Cleveland, Doehler Die Casting Plant at Chicago — and many others. Facts on specialized atmospheric problems that can be solved with Swartwout Equipment may be had for the asking.

THE SWARTWOUT COMPANY
18511 Euclid Ave., Cleveland 12, Ohio



Swartwout

Specialists in Air Movement by *Natural* Methods

proper balance between the twin objectives of holding a stable price level and facilitating and encouraging production. Business has the responsibility of setting prices at levels which will achieve maximum output and distribution of goods, and seeking profits in volume rather than in exorbitant margins. Workers for their part have to realize that they face new conditions. There was never any danger that the cost of war products would price them out of the market, for the armed forces had to pay what war required. But civilian buyers are not usually in that position. The wages that industries can pay for peacetime work are limited by what consumers can pay for the product, and in the long run this will be the governing factor.

•

Make Surplus Property Provide More Jobs

IRA MOSHER, President, National Association of Manufacturers, in a broadcast

When we talk about surplus war plant *disposal*, actually most of us are concerned with *utilization*.

Of course, we've got to "get rid" of the plants.

But we must do it in such a way as to get out of them afterwards peak *production* for everybody and the *largest possible employment* for veterans and displaced war workers.

If we don't, we'll be sorry.

The plants cost us around 16 billions. We had to build them fast and to heck with the expense. Consequently we'll never sell them for what they cost.

Some can't be sold at all.

That's part of the price of victory. And who wouldn't rather pay that way, than in the lives that delay would have cost?

But if remaining plants are offered at fair prices, to be immediately operated and sold to speculators, they'll supply jobs. All that government then will have to do, is keep out of unfair competition and give them a chance.

Nobody has to take my own or any other individual's personal formula on disposal. But let me tell you what top men in 65 companies which starred in the miracle of war production recommend. They make up the National Association of Manufacturers' Committee on Disposal of Government-Owned Plants and Materials, and here is what they urge:

Publicize the whole procedure. Keep it an "open book," for you can't help *more* companies make *more* jobs by keeping half of them in the dark.

Negotiate sale *in advance* of declar-

ASBESTOS IN ACTION

. . . on BIG jobs, it's "Century" ASBESTOS CORRUGATED

. . . and little jobs, too

Many of the country's leading industrial plants enjoy the *advantages* of K&M "Century" ASBESTOS CORRUGATED roofing and siding.

WHY NOT HAVE THESE SAME ADVANTAGES IN *YOUR* PLANT?

TOUGHNESS . . . asbestos fibres and portland cement are combined under tremendous hydraulic pressure to form a sheet of asbestos corrugated.

ADAPTABILITY . . . suited for new construction or additions and repairs to existing structures. Comes in one standard width, and in 19 different lengths adaptable for every need.

ATTRACTIVENESS . . . does not require painting or surface finish of any kind . . . has its own pleasing, practical finish.

ECONOMY . . . an actual money-saver . . . is maintenance-free for the life of the structure. Will not rust or corrode.

FIRE-RESISTING . . . this means no risk, lower insurance rates and a completely fireproof wall and roof.

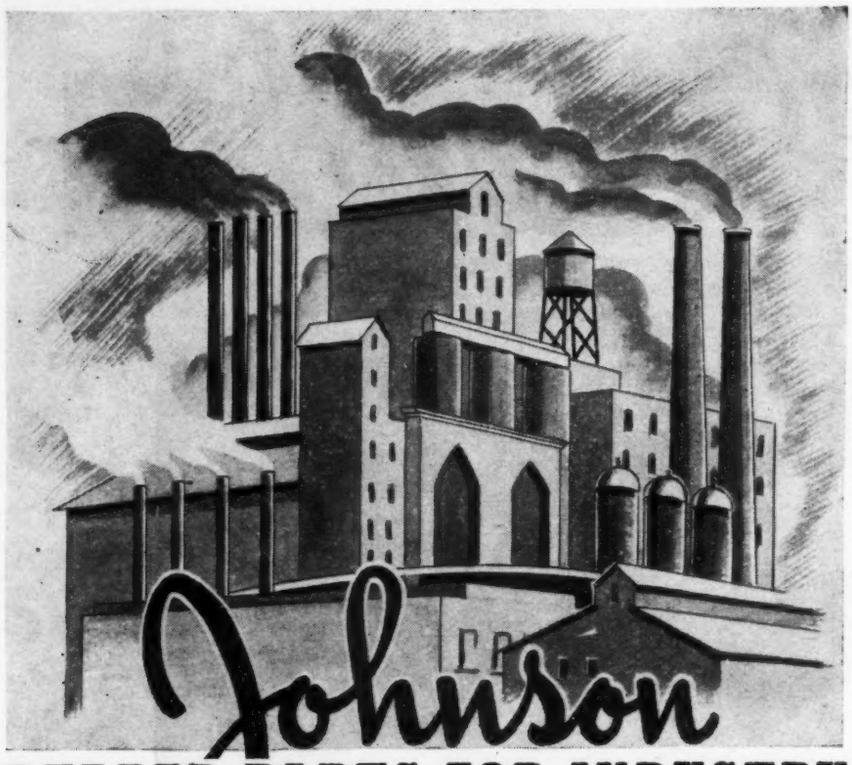
TIME-SAVING . . . installation time is reduced to a minimum, so, here too, low costs are maintained.

Save time and money the "Century" way . . . bring your problems to your authorized Keasbey & Mattison distributor. He is well supplied to meet your material and installation requirements for "Century" Asbestos Corrugated and Flat Lumber.

Nature made Asbestos . . . "Century" Asbestos Corrugated and Flat Lumber is an outstanding example of how Keasbey & Mattison has made Asbestos serve modern construction.

KEASBEY & MATTISON

COMPANY · AMBLER · PENNSYLVANIA



RUBBER PARTS FOR INDUSTRY

Many and varied are the uses for both extruded and molded rubber parts for industry and Johnson Rubber Company has for years been creating, designing, and manufacturing rubber parts for manufacturers in a wide variety of industries.

Our engineering skill... mass precision methods and great production facilities are at your disposal. We know how, when and where to put rubber parts to work advantageously.

If you have a problem or if you are in search of a reliable source of supply of rubber parts just drop us a line.

THE JOHNSON RUBBER CO.

MIDDLEFIELD, OHIO

ing plants to be "surplus," so buyers can get set in advance for production and payrolls.

Sell outright, but don't let plants shut down for lack of a sale. Lease for long terms, if that will keep them going. If an entire place can't be used, lease the part that can be used.

And watch out for tax abatement schemes to attract buyers. Obviously, special privileges that discriminate against one business while subsidizing another kill an old job for every new one they create. The main point is to make the increasing of productive employment the over-all guide, and to keep it so.

Men who urge these measures speak from experience, for they manage companies each providing from a couple hundred to several thousand jobs. Their aim is high-level production and employment.

I'm sure . . . that's the Number One goal of all of us.

•

What Kind of Supervision Do Women Like?

The generally accepted theory that women object to being supervised by women would seem to be disproved by the answers to a questionnaire recently sent to women employees by Stromberg-Carlson Company, Rochester, N. Y.

Of the group of women surveyed, 14 percent wanted women supervisors, 51 percent believed the sex of the supervisors made no difference, and 35 percent wanted men foremen.

The survey also undertook to isolate and examine some of the personality and age factors involved in the relationship between women factory employees and their supervisors.

Answers to the age question revealed that the "good" supervisor is several years older than the average of the group he supervises; 30 percent said the "good" supervisor is married, one 1 percent preferred an unmarried supervisor. The remaining 69 percent said it didn't matter.

Twenty-two characteristics of a "good" supervisor were listed. The attributes that rated the greatest number of check marks, in order of their popularity, were: (1) Has a thorough understanding of his job; (2) has work carefully planned in advance; (3) is neat, clean, and well-groomed; (4) is pleasant, amiable, and good-natured; (5) criticizes quietly and constructively.

Least-liked supervisors are those (1) whose reserve does not allow them to associate with the workers; (2) who

HANDLING+Processing+HANDLING+Assembling+HANDLING+Packing+HANDLING+Storage+HANDLING

HANDLING—the Common Denominator of PRODUCTION

LET MEN DIRECT POWER—NOT GENERATE IT!

Cubic transportation—Lifting and placing as well as carrying—is essential to efficient handling. *Where* a product is handled is just as important as *how* it is handled.

Towmotor, capable of moving materials in any plane from floor level to a 20 foot height, provides a means of utilizing all available space. The Towmotor DATA FILE contains details. Your copy is ready now.

TOWMOTOR

THE ONE-MAN-GANG

TOWMOTOR CORPORATION • 1238 E. 152ND STREET, CLEVELAND 10, OHIO

Now–No Need to Tolerate Smelly Disinfectants!
There's Absolutely NO ODOR OF ANY KIND WHEN YOU USE
ODORLESS
Sasoco Disinfectant
PATENT PENDING
★Non-Toxic
★Non-Irritating
★Highly Germicidal
Odorless Sasoco brings about a more conducive working atmosphere in factories by thoroughly cleaning walls, floors, wash rooms and supply rooms, and thus, guaranteeing perfect sanitation throughout. It cuts down the danger of spreading germs, and leaves a fresh, ODORLESS after-effect. It is highly fungicidal and absolutely harmless to hands. Sasoco cleans, disinfects, deodorizes in ONE operation, and is constantly undergoing outside, unbiased laboratory tests to check its efficiency.
Available in Phenol Coefficient:
4-5 Industrial Grade—Also 2-3 8-9
Completely Stable in Storage or in Solution
Packed in 55 and 30-Gallon Drums
5 and 1 Gallon Cans
SANITARY SOAP CO.
Mfrs. of Soaps and Disinfectants Since 1921
104 RAILROAD AVE., PATERSON 3, N. J.

THEY SAY AND DO *(continued)*

are easy-going; (3) who are strict; (4) who have no personal interest in the worker.

•

What a "Full Employment" Plan Would Cost

SEN. ROBERT A. TAFT, before National Industrial Conference Board, opposing a federally guaranteed "Full Employment" plan

(Following is part of the approved condensation of Senator Taft's speech, as printed in the Citizens National Committee's Research Report No. 2-417)

Full employment at good wages for every man and every woman who wishes to work in the United States is a goal devoutly to be wished. No questioning of its existence as a legal right in any way detracts from the desire of the questioner to attain the ideal. "Good wages" means perhaps $2500 a year. Obviously a goal of $5000 a year apiece, or $25,000, is even more desirable.

The distinction is between an ideal or hope and a right that can be conferred by law. However, to give the government the legal duty to guarantee full-time employment is impossible, though there are many steps it can take toward that goal.

Our high standard of living is the result of the application of freedom to individual activity, not the guaranty of jobs. That freedom can be qualified so that it does not include the freedom to throw monkey wrenches in the machine. The economic machinery can be oiled and speeded up and improved. But a guaranty of work by the government to every individual is wholly inconsistent with the very freedom which has produced the machine which provides jobs at good wages.

The whole policy sounds so easy and attractive that it has been thoughtlessly accepted by many without analysis. But what is "full employment" and what is a good wage? Is this to be a guaranty of any job a man wants in any industry, or is it to be such a job as the government chooses to provide?

Any direct guaranty of full-time jobs at good wages would involve the government in the placement—and ultimately the assignment—of every man and woman in the country.

This suggests that the government would have to go into many fields of non-government activity. The government could take over factories and make clothing, food, and other necessities to be given away to the low income groups. The difficulty is that

HARRISON
OIL COOLERS
Control Lube Oil Temperature

LESSEN WEAR—INCREASE EFFICIENCY

Production men know that Harrison oil coolers increase machine efficiency by maintaining lube oil temperatures within the range required for proper lubrication.

Properly cooled oil prevents excessive wear on bearings and other critical parts, and results in less time out for costly overhauls.

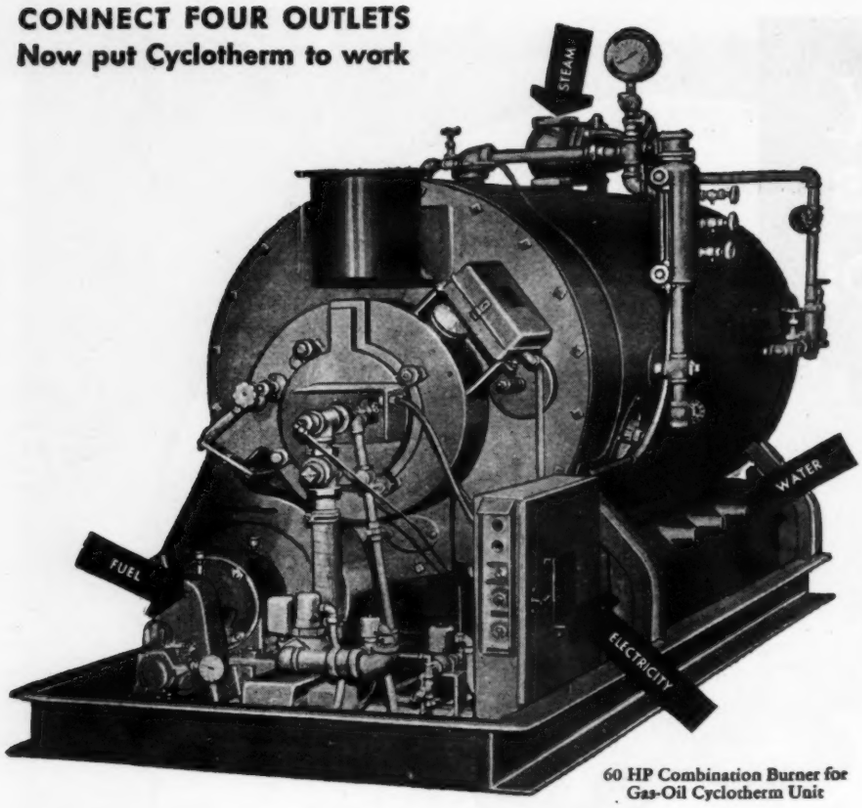
Harrison oil coolers, designed in types and sizes for practically every industrial application, contribute much to machine efficiency through effective temperature control.

Harrison engineers are available to work with you on problems of machine temperature regulation.

We Are At War—
BUY WAR BONDS

HARRISON
HARRISON RADIATOR DIVISION OF
GENERAL MOTORS, LOCKPORT, NEW YORK

CONNECT FOUR OUTLETS
Now put Cyclotherm to work



60 HP Combination Burner for Gas-Oil Cyclotherm Unit

Order your post-war Cyclotherm now

Cyclotherm Steam Generators are available to industry on a peacetime basis, *without priority for immediate delivery.*

With fuel restrictions lifted, you will want to modernize your power plant with a Cyclotherm Steam Generator.

Whatever your use of steam, the immediate answer is a completely assembled, packaged Cyclotherm unit.

Cyclotherm is emerging from the war with a veteran's reputation for delivering results under all kinds of service conditions.

Thousands of Cyclotherm units have been in service throughout the world with the Army, Navy and Marine Corps.

Cyclotherm's record of service is your best guarantee of its builders' engineering "know-how" and the quality built into a Cyclotherm unit.

Cyclotherm units range from 10 HP to 200 HP. They are completely self-contained, automatic, oil or gas fired. They are designed on unique principles of combustion that give top efficiency and service while holding operating and maintenance costs to a minimum. This packaged steam generator will give you years of continuous, trouble-free, economical service.

Orders are being filled promptly.

CYCLOTHERM
STEAM GENERATOR

CYCLOTHERM CORPORATION, BOX 106
90 BROAD STREET, NEW YORK 4, N. Y.

the moment the government enters such a field, private capital is afraid to go ahead. You hamper and discourage the very economic machine on which you are relying to produce prosperity.

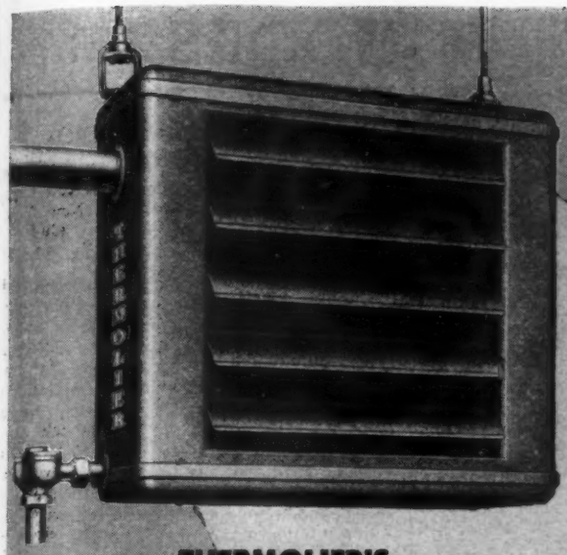
The post-war budget of the government will be at least $20,000,000,000 for expenses that we cannot escape, four times our pre-war budget. It may be possible to find a tax system that will raise this much without discouraging initiative. But if we add up the additional government spending proposed by the guaranty theory, we reach $40,000,000,000 or $50,000,000,000. Either a tax system must be imposed at even higher rates than the war system, or we must increase the debt by somewhere between $15,000,000,000 and $30,000,000,000 a year. Either of these alternatives would destroy the economic machine upon which our prosperity has been based.

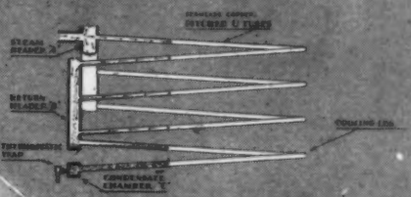
If the present tax rates on business are continued, there will be no incentive to anyone either to put his money into new business or to expand old business. One industry after another will become unprofitable. The government will have to finance necessary expansion and will gradually absorb industries one by one.

How to Attain Prosperity

The path to prosperity and happiness at home cannot be solved by any panacea of public spending or a government guaranty of "full employment." It can be achieved only by the gradual speeding up of the great private economic machinery upon which our prosperity depends. That is an infinitely delicate machine. To secure the best results prices must bear the right relations to wages and wages to prices. There must be an accurate adjustment between the production of capital goods and consumers' goods. There must be incentive to save and invest and work and open up new fields. There must be continued reward for hard work and ability and the willingness to take a chance.

There must be a free choice of employment so that every man may choose that profession or calling to which he is best suited. The progress which we have achieved under the American system in the last 150 years at least suggests that we had better rely on it a while longer. It has the advantage of being based on freedom of the individual as no other economic system is based. Let us not give up our guaranty of freedom for a spurious guaranty of employment.





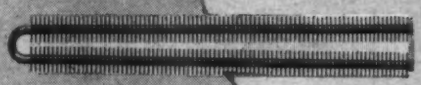
Thermolier's
INTERNAL COOLING LEG
(PATENTED)

Insures continuous drainage of condensate . . . maximum radiation from all surfaces at all times!

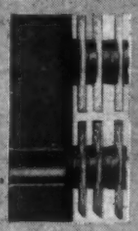
The exclusive Thermolier Internal Cooling Leg is No. 1 of the twelve reasons for the superiority of this unit heater. Besides insuring *all* the heater working *all* the time, it permits the use of a thermostatic trap, the simplest and least expensive of all traps. Drainage is continuous, eliminating damage by water hammer due to intermittent drainage cycles. ***The Internal Cooling Leg built into Thermolier gives cooling effect of 100 feet of usual external cooling leg piping.***

A Grinnell Engineer will be glad to demonstrate this and other points of superiority of Thermoliers. He'll show you how Thermoliers will distribute heat uniformly to every square foot of your buildings and save up to 27% of still-scarce fuel. Ask for the new Grinnell Thermolier Catalog 6-E. It gives all the details of construction, application, capacities and installation. Grinnell Company, Inc., Executive Offices, Providence 1, R. I. Branch Offices in Principal Cities.

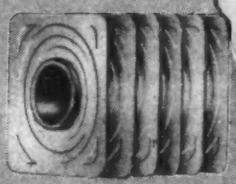
THERMOLIER'S SUPERIOR FEATURES



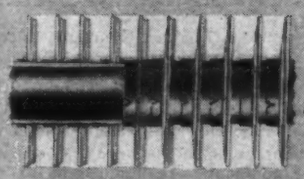
BUILT-IN EXPANSION PROVISIONS. The "U" type tubes allow expansion and contraction, ease damaging strains.



LEAKPROOF TUBE-TO-HEADER CONSTRUCTION. Joints made by the expanding method assure safety and durability.



SUPERIOR HEATING ELEMENT. Square copper fins on strong seamless copper tubing provide 24% more radiating surface.



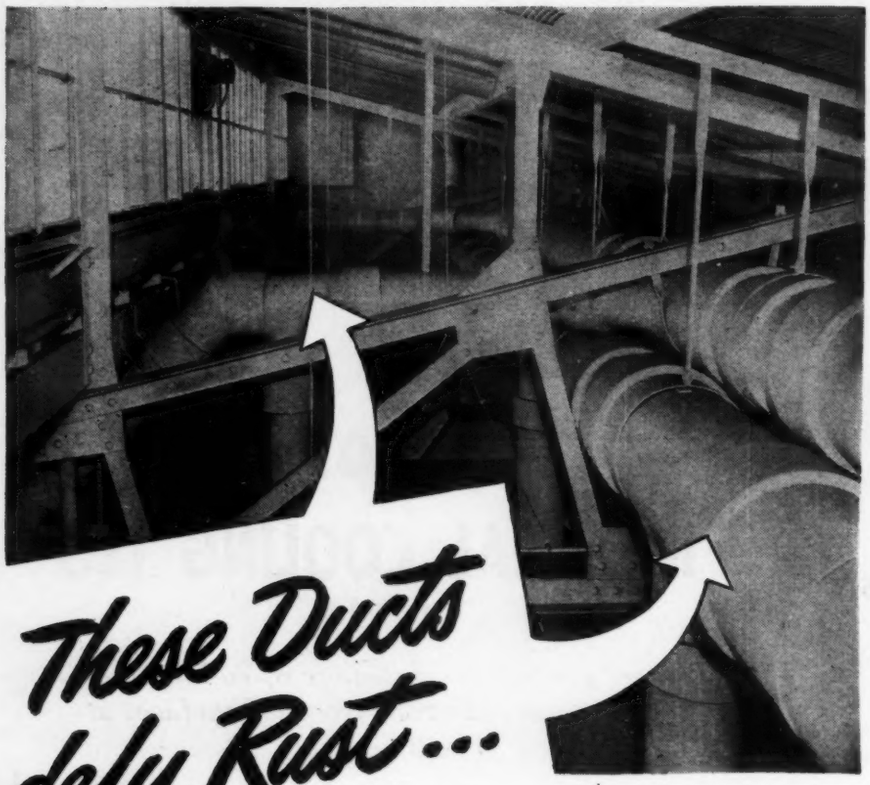
TUBE DESIGN MINIMIZES DIRT COLLECTION. Finned U-tubes with no flat horizontal fin surfaces minimize dirt collection which decreases efficiency. 89% of heating surface is vertical fins, 11%, round horizontal tubes.

Other Points of Thermolier Superiority — built-in drainage • continuous rated capacity • heavy frame gives greater rigidity • motor and fan meet specific Thermolier requirements • simple piping connections • adjustable hangers facilitate erection • packed for easy installation.

GRINNELL

FOUNDED 1850

Thermolier Unit Heaters
FOR FULL VALUE FROM FUEL DOLLARS



These Ducts defy Rust...

withstand Corrosion by many industrial fumes, vapors, gases

DO RUST AND CORROSION play havoc with your venting system? Many users are finding that Johns-Manville Transite "S" Pipe offers a practical answer to this problem. Made of asbestos and cement, it is completely rustproof . . . successfully resists many types of corrosion encountered in industrial venting systems.

Rotproof and highly weather-resistant, Transite "S" Pipe can be used either indoors or outdoors—for ducts, vents and stacks—without painting or other surface protection.

Installations, such as the one shown, present no problem because Transite "S" Pipe is light in weight, easily assembled, and comes in a range of 19 sizes—diameters from 2" up to 36". A complete line of fittings is also available.

For full information, write for data sheets DS Series 336. Address Johns-Manville, 22 East 40th Street, New York 16, New York.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville TRANSITE 'S' PIPE

BOOKS

UNDERSTANDING LABOR

Bernard H. Fitzpatrick, Member of New York Bar, Industrial Relations Director, Commerce and Industry Association, New York. McGraw-Hill Book Co., 330 West 42nd St., New York 18. 179 pages. Appendix. $2.

One of the "Industrial Organization and Management Series." Analyzes labor phenomena for those who would like to understand the meaning of various contradictory forces in the realm of labor relations. Explanations center around (1) an appreciation of the differences between casual labor and tenure labor; (2) a recognition of the monopoly characteristics of the traditional union forces; (3) a recognition of the novelty of the introvert industrial union form; (4) a recognition of the incompatibility of the institutions proper to traditional union forms with the new introvert form. Thirteen chapters, including "A Look Backward"; "Craft, Industrial, and Heterogeneous Unions"; "Organizational Differences—Casual and Tenure Labor"; "Monopoly Unions"; "The Railway Labor Act"; "The Corporate State"; "The Wagner Act Generally Considered"; "The Closed Shop and Related Arrangements"; "Introvert Industrial Unions."

DYNAMICS OF TIME STUDY

Ralph Presgrave, Vice-President, J. D. Woods & Gordon, Ltd., Toronto, Canada. McGraw-Hill Book Co., 330 West 42nd St., New York 18. 238 pages. Index. $2.50.

One of the "Industrial Organization and Management Series." Second edition. To some extent a philosophical approach, relating time and study to the fundamental physical capacities of the human individual when performing manual work, book analyzes the essential principles to which sound time study technique must conform, and describes practical methods for applying those principles. The sixteen chapters include "Time Study and 'Scientific' Management"; "Implications of Measurement"; "Time Study as Measurement"; "Leveling"; "The Distribution of Human Capacities"; "Range and Frequency in Productive Operations"; "Time Study, Incentives, and the Range of 'Effort'"; "The Three Problems of Time Study"; "Effort Rating"; "Allowances." A summary is appended.

PROCEDURE HANDBOOK OF ARC WELDING DESIGN AND PRACTICE

The Lincoln Electric Company, Cleveland. 1282 pages. Photographs, figures, drawings, index. $1.50 in the USA; $2 elsewhere.

Eighth edition. Revised to include the latest data on new arc welding methods and equipment. In eight parts—Welding Methods and Equipment; Technique of Welding; Procedures, Speeds, and Costs; Weld Metal and Methods of Testing; Weldability of Metals; Welded Steel Construction—Machine Design; Designing of Arc-Welded Structures; Typical Applications of Arc Welding in Manufacturing, Construction, and Maintenance.

BUSINESS EXECUTIVE'S GUIDE

J. K. Lasser, Chairman, Institute of Federal Taxation, New York University. McGraw-Hill Book Co., 330 West 42nd St., New York 18. 252 pages. $3.

Subtitled "A Check List on Problems of Organization, Finances, Taxes, and Management." Book lists the necessary steps in many funda-

GAS FUEL burned in an acid bath

Photos courtesy Submerged Combustion Co. of America, Inc., Hammond, Ind.

BY YEARS

advances metal pickling technique

Simplifying an old but important operation in metals fabrication, newly developed Gas equipment has advanced by years the process of metal pickling in an acid bath.

A Gas burner made of a highly acid resistant alloy is submerged in the acid bath and through the use of compressed air, Gas fuel—burning right in the liquid bath—does three jobs at once. It heats, circulates and agitates the acid bath. The combustion unit can withstand a temperature of 2900°F. and a concentration of sulphuric acid ranging up to 100%.

The flow of compressed air clears the burner unit of solution and the Gas is then ignited. When the bath is heated to the desired temperature, the Gas automatically shuts off while the compressed air continues to agitate the acid. As the temperature goes down, the Gas is automatically reignited to maintain the pre-set temperature. The entire operation represents a degree of compactness and high efficiency that has long been wished for in this field.

Whatever treatment of metals commands your interest, you can be sure that modern Gas and modern Gas equipment will do a better job for you. The Industrial Engineer of your local Gas Company is available for consultation, and you incur no obligation.

THE TREND IS TO GAS

FOR ALL INDUSTRIAL HEATING

AMERICAN GAS ASSOCIATION
INDUSTRIAL AND COMMERCIAL GAS SECTION
420 LEXINGTON AVENUE, NEW YORK 17, N. Y.

YOUNG UNITS *Now Available*

Here's GOOD NEWS!

Young *All-Copper Coil* Unit Heaters are available without priority.

Now you can include Young Heater Units in your plans for a complete new heating system, or to supplement your present plant. Young Unit Heaters, in both vertical and horizontal discharge types, will be manufactured as fast as materials are available. Contracts will be filled in the order in which they are placed.

"Streamaire" *all-copper coil* Units are made in a wide range of types and sizes to meet every heating and air-conditioning requirement. They save floor space . . . offer easy installation . . . efficient operation . . . low "first" and maintenance costs. They provide proper radiation and heat . . . eliminate stratification . . . and save fuel costs.

To assure your plant the most efficient and economical heating system for your specific requirements call on Young heating engineers to assist you in determining the proper types, the number of units and where they should be located. Take advantage of Young's two decades of heat transfer engineering experience . . . without obligation. Write today for full information and catalog.

YOUNG
HEAT TRANSFER PRODUCTS

Oil Coolers • Gas, Gasoline, Diesel Engine Cooling Radiators • Heat Exchangers • Intercoolers • Engine Jacket Water Coolers • Unit Heaters • Convectors • Condensers • Evaporators • Air-Conditioning Units • Heating Coils • Cooling Coils • and a Complete Line of Aircraft Heat Transfer Equipment.

YOUNG RADIATOR CO., Dept. 125-K • RACINE, WISCONSIN, U. S. A.

Application Engineers in Principal Cities

mental matters of organizing, financing, and managing a business. Check lists are compiled to relieve the businessman of reliance on his memory—thereby freeing time, effort, and imagination for devotion to more creative aspects of his business.

INTERNATIONAL TRADE AND DOMESTIC EMPLOYMENT

Calvin B. Hoover, Dean of the Graduate School of Arts and Sciences, Duke University. McGraw-Hill Book Co., 330 West 42nd St., New York 18. 177 pages. Index. $1.75.

Fifth in the series of research studies for the Committee for Economic Development. Takes up the relationship of international trade to our domestic prosperity, and our role in the well-being of other countries. Discusses the question of our future merchant marine; examines the possibilities for reducing or eliminating tariffs and similar checks on imports; appraises the position of international cartels and domestic monopolies. Nine chapters: "The Determination of National Policy in International Trade"; "The International Monetary Fund"; "The Problem of International Loans and Investments. The International Bank for Reconstruction and Development"; "The New Forms of Trade Barriers. The Growing Importance of Cartels in International Trade"; "Our Tariff Policy"; "Our Lend-Lease Policy; "Our Mercantile Marine Policy"; "The Problem of Our New and Overexpanded War Industries"; "Prospective Trends in Our Foreign Trade."

BOOKLETS

BASIC GUIDE FOR LABOR MANAGEMENT COMMITTEES. Ways of Operating a Labor-Management Production Committee. War Production Drive Headquarters, War Production Board, Washington, D. C. 31 pages. Cartoon drawings. No charge.

CHLORINE. Exposure to high concentrations due to accident or carelessness may stifle, inflame lungs, kill. Controlling Chemical Hazards, Series No. 2. Division of Labor Standards, U. S. Department of Labor, Washington 25, D. C. 14 pages, pocket size. Up to 25 copies, no charge; larger orders, 10c a copy; 25 percent discount on orders of 100 or more.

FULL EMPLOYMENT AND THE NATIONAL BUDGET. A discussion of the Murray Full Employment Bill. Research Report No. 2-417. Citizens National Committee, Inc., 2633 16th St., N. W., Washington 9, D. C. 22 pages. No charge.

METHOD OF INDEXING PROVISIONS OF COLLECTIVE AGREEMENTS. Second edition. Revised by May E. Jamieson, Research Assistant, Industrial Relations Section, California Institute of Technology. California Institute of Technology, Pasadena 4, Calif. 16 pages. $1.

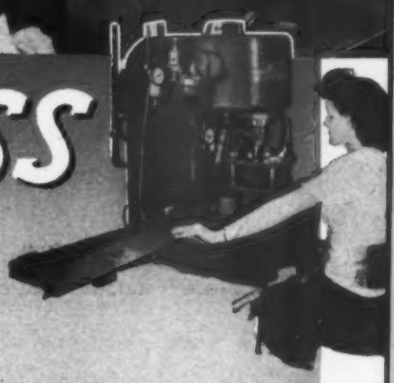
ON THE CALENDAR

OCTOBER

10–11, American Management Association. General Management Meeting, Waldorf-Astoria Hotel, New York. Saul Poliak, 330 West 42nd St., New York.

29–30, American Management Association, Pro-

Deep-drawn containers produced at high speed and less cost with . . . . . MULTIPRESS



Buckeye Stamping Saves 66% on Floor Space . . . 33% on Initial Investment

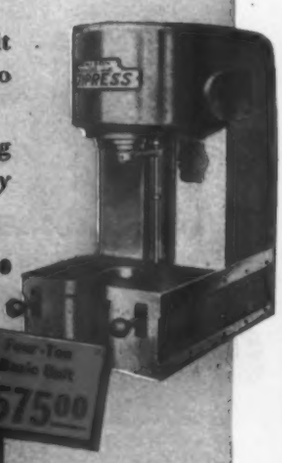
MULTIPRESS *blanks and draws* seamless metal cans and boxes at the rate of one every second, in The Buckeye Stamping Company plant at Columbus, Ohio — a blanked and formed container with each complete ram stroke! And along with this high-speed production, MULTIPRESS saves *two-thirds* of the floor space previously used . . . features a relief valve that prevents damage to dies in case work jams . . . requires less experience for skillful operation . . . reduces fatigue and increases safety for the operators. *And cost of the complete MULTIPRESS installation was one-third less than equipment formerly required!*

These MULTIPRESS savings are typical. Its performance in scores of plants on dozens of operations proves that MULTIPRESS is Industry's New Tool of amazing advantages.

MULTIPRESS is an extremely compact, bench-size, oil-hydraulic machine tool, built in four, six and eight-ton capacities. Ram pressures are regulative from 300 pounds to capacity . . . ram strokes from $\frac{1}{32}$-inch to capacity.

Get full details on MULTIPRESS and its remarkable accessories—including indexing tables . . . straightening fixtures . . . automatic cycling controls . . . *and the revolutionary* VIBRATORY *ram action all Industry is talking about!* Write today!

The DENISON Engineering Company, 1154 Dublin Road, Columbus 16, Ohio



HydrOILics INDUSTRY'S RIGHT

DENISON
EQUIPMENT in APPLIED
Hydr OIL ics

Government-owned equipment must be *RUST-PROOFED* before lay-up

Remember—you are required to rust-proof all Government-owned production equipment immediately upon termination of your war contract.

Only rust-proofing products accepted under Ordnance Specification PS 300-4 are approved for this purpose. TECTYL is so approved and there is a TECTYL product to meet every requirement.

TECTYL seals out moisture, protects against rust and corrosion for as long as two years—indoors and out. A little TECTYL covers a lot of metal.

Don't overlook the value of TECTYL as a rust and corrosion preventive on your peace-time products. Used on materials-in-process and on completed units, TECTYL can prevent serious losses from spoilage.

Write today—tell us your corrosion problem and we'll send you a Tectyl bulletin with complete application data.

TECTYL
STOPS RUST

VALVOLINE OIL COMPANY

431 Main Street, Dept. 22 J, Cincinnati 2, Ohio

Refinery at Butler, Pennsylvania — General Offices, Cincinnati, Ohio

New York-Atlanta-Pittsburgh-Chicago-Detroit-Los Angeles-Vancouver, B. C.-Washington, D. C.

duction Conference, Palmer House, Chicago. James O. Rice, Asst. Secretary, 330 West 42nd St., New York.

NOVEMBER

14–15, American Management Association, Office Management Conference, Hotel New Yorker, New York. Saul Poliak, 330 West 42nd St., New York.

30–Dec. 1, Society for the Advancement of Management, Annual Conference, Waldorf-Astoria Hotel, New York. Carl S. Coler, Executive Director, 84 William St., New York.

DECEMBER

6–7, American Management Association, Finance Conference, Hotel New Yorker, New York. Henry J. Howlett, Secretary, 330 West 42nd St., New York.

7, American Leather Belting Association, Annual Meeting, Commodore Hotel, New York. E. R. Rath, Executive Vice-President and Secretary, 41 Park Row, New York.

7, American Standards Association, Annual Meeting, Biltmore Hotel, New York, Dr. P. G. Agnew, Secretary, 29 West 39th St., New York.

10–12, The American Society of Refrigerating Engineers, 41st Annual Meeting, Hotel Pennsylvania, New York. Charles Leopold, Program Committee Chairman, 50 West 40th St., New York.

11–12, National Association of Suggestion Systems, National Conference, Hotel Sherman, Chicago. F. A. Denz, Chairman, Public Relations, 122 South Michigan Ave., Chicago.

16–18, American Institute of Chemical Engineers, Annual Meeting, Stevens Hotel, Chicago. S. L. Tyler, Executive Secretary, 50 East 41st St., New York.

COURSE IN ENVIRONMENTAL CONTROLS

OCTOBER

2–4, Inservice Training Course in Environmental Controls for Industrial Processes. H. E. Miller, Resident Lecturer in Public Health Engineering, School of Public Health, University of Michigan, Ann Arbor, Mich.

COURSE IN QUALITY CONTROL

NOVEMBER

6–16, Course in Quality Control by Statistical Methods. State University of Iowa. Professor Earle L. Waterman, College of Engineering, State University of Iowa, Iowa City.

Meetings Canceled

OCTOBER

American Institute of Accountants, Annual Meeting, scheduled for October 22. John L. Carey, Secretary, 13 East 41st St., New York 17.

American Society for Metals, National Metal Congress and Exposition, Cleveland. W. H. Eiseman, Secretary, 7301 Euclid Ave., Cleveland 3.